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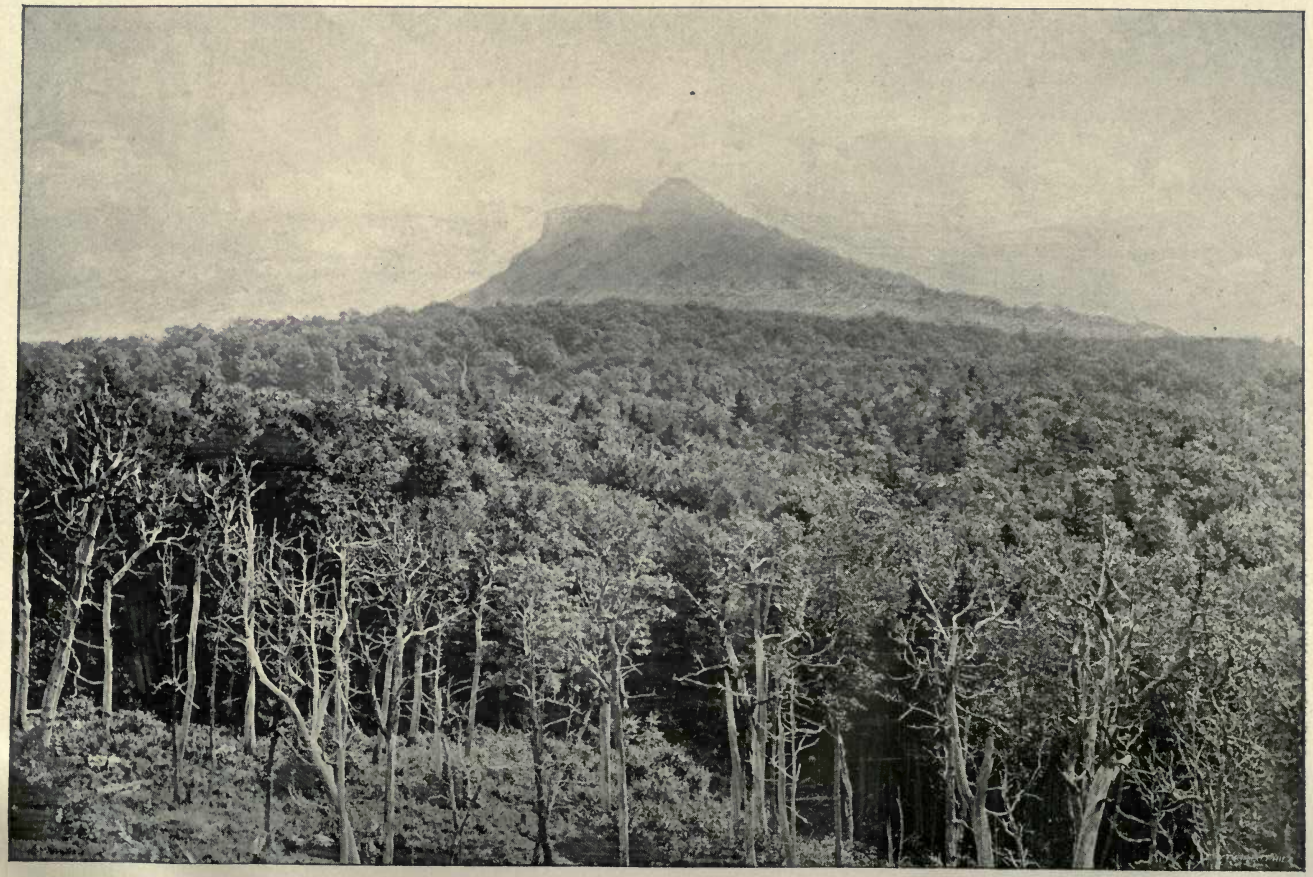

HARDWOOD FOREST ABOUT GRANDFATHER MOUNTAIN

NORTH CAROLINA GEOLOGICAL SURVEY.

J. A. HOLMES, STATE GEOLOGIST.

Walter Mulford

BULLETIN No. 6.

TIMBER TREES AND FORESTS OF NORTH CAROLINA.

GIFFORD PINCHOT

AND

ELLWOOD SHERFESEE.

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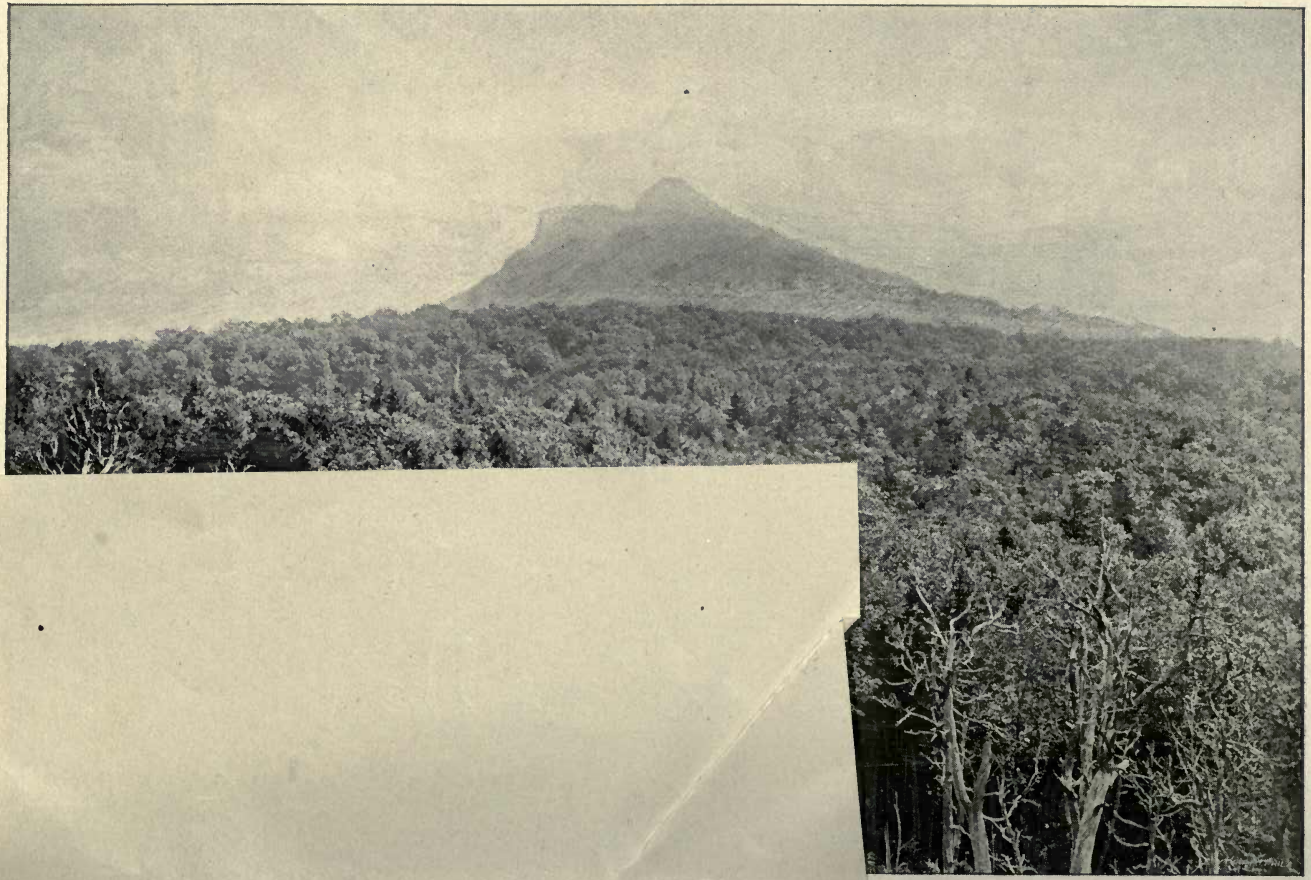

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M. I. & J. C. STEWART, Public Printers.
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LETTER OF TRANSMITTAL.

CHAPEL HILL, N. C., June 19th, 1897.

To his Excellency, GOV. D. L. RUSSELL,
Chairman Geological Board, Raleigh, N. C.

SIR :—I beg to submit for publication as Bulletin 6 of the Geological Survey series, a report on the timber trees of North Carolina, by Mr. Gifford Pinchot, and a report on the forests and forest conditions in North Carolina, by Mr. W. W. Ashe. Mr. Pinchot has prepared his portion of this bulletin free of charge for services, and I regard his paper as one of the most valuable which has been prepared for the survey.

There is already a large demand for copies of this bulletin, even in advance of its being published, and its distribution will serve to answer a number of inquiries from many portions of the country, concerning the timber supplies in North Carolina.

With great respect, I beg to remain,

Yours obediently,

J. A. HOLMES,
State Geologist.

PREFACE.

The present Bulletin was planned as a part of the North Carolina forest exhibit at Chicago. It was begun before the opening of the World's Fair, but, for reasons which need not be recited here, remained unfinished. Since that time it has been continued under stress of other work as opportunity arose, and has reached it present condition only after long delays.

It is intended, first, to present a succinct statement of certain salient characteristics of the more important trees of North Carolina. The forest flora of no other State is more varied, nor in many ways so interesting as this. Partly for this reason, and partly for the uses of this Bulletin in identifying trees throughout the State, a close restriction to those species which are of present value for lumber has not been maintained.

The second part of the Bulletin, a short account of the various forest regions of the State, is contributed entirely by Mr. Ashe, whose acquaintance with the woodlands of North Carolina is so much more extensive than my own that I have thought it best not to attempt to edit his MS. in any way.

In all matters of punctuation, capitalization, and nomenclature, I have preferred to follow the established usage of the Geological Survey throughout, rather than depart from it in a few cases where my individual preference might have been different.

The material contained in the acccunts of the various trees has been gathered chiefly from various publications, assisted by such personal observations as I have been able to make, or as have been contributed by different observers. I have to express my indebtedness in particular to Prof. Sargent's magnificent "Silva of North America," to Dr. Curtis' "Trees of North Carolina," and to Dr. Chapman's "Flora of the Southern States." Other authorities have been consulted in the course of preparation, but these are the principal ones.

The silvicultural notes, largely tentative in character as they must necessarily be, are intended to refer only to the bearing of each species in North Carolina.

Besides Mr. Ashe, to whose notes I am indebted for the descriptions of the root systems and for other material, and myself, many others have joined in the work, but it would carry me too far to acknowledge their services in detail. I must ask them to accept this general expression of my sincere appreciation of their assistance.

GIFFORD PINCHOT.

New York, Nov. 26, 1896.

KEY FOR THE DETERMINATION

OF THE

LARGER NORTH CAROLINA FOREST TREES.

BY

WILLIAM WILLARD ASHE.

KEY FOR THE DETERMINATION

OF THE

LARGER NORTH CAROLINA FOREST TREES.

By W. W. Ashe.

The analytical key given below for the determination of the larger forest trees is based on those characters which are most accessible and can be obtained throughout the greater part of the growing season. A short explanation of some of the terms used is given, which may be of some service.

Opposite leaves are two leaves placed opposite one another, one on either side of the twig. *Alternate leaves* are leaves not so placed in pairs along the twig.

The *leafstem* is the stalk on which the leaf stands and by which it is fastened to the twig. A *simple leaf* is one whose leafstem is attached directly to the twig; a *compound leaf*, one formed of numerous separate small leaves, or *leaflets*, which are attached at the end of a common leafstem or along either side of a common leafstem. The leaflets along the leafstem can be arranged opposite each other or alternately.

A *bud* is placed on the twig at the bottom of each leafstem. It is generally a small brown prominence or spur formed of overlapping scales. Those buds at the end of the twig are larger than those below, and the usual reference is to the end or terminal bud. Buds do not reach their full size and color until about the middle of July, but they can be clearly seen as soon as the leaves and twig are mature in spring. Most buds are placed on the twig just above where the leafstem joins it; some buds, however, are concealed in a cup hollowed out of the base of the leafstem. It is important to know where the bud is, as compound leaves are

determined in this way, the small leaflets which make them having no buds where they join the leafstem, which otherwise might be taken for the twig.

The *twig* is the growth of the season. Most trees have the buds and the leaves, which grow from the same point, scattered rather regularly along the twig, only one or rarely two being at the end of the twig; the oaks, however, have from three to five such buds and leaves crowded at the end of the twig, besides those on the stem below, and this characteristic grouping of the buds is used to separate these trees from all others. Two of the magnolias have their leaves and buds so grouped, but on account of the large size of the leaves these will not be confused with the oaks.

The figures in parenthasis refer to the page on which a more lengthy description will be found.

I. CONIFERS, TREES WITH LIMBS, CHIEFLY EVERGREEN AND RESIN-BEARING, WITH LEAVES RARELY $\frac{1}{12}$ INCH BROAD.

(1) LEAVES OVER ONE INCH LONG, NEEDLE-LIKE, FROM 2 TO 5 COLLECTED IN A SHORT SHEATH.—*Pines.*

(*a*) Leaves 5 together; bark of small limbs whitish or gray. (p. 123.)..... WHITE PINE.

(*b*) Leaves 3 together.

Leaves 10 to 15 inches long; bud at end of the twig covered by many ragged, silvery bracts. (p. 131.)..... LONG-LEAF PINE.

Leaves 6 to 10 inches long; bud small and resinous; cone or burr cylindrical, 5 to 6 inches long. (p. 125.)..... LOBLOLLY PINE.

Leaves 4 to 8 inches long; small bud resinous; cone top-shaped; trees of eastern swamps. (p 127.)..... POND OR SAVANNA PINE.

Leaves 3 to 5 inches long; cone top-shaped; western trees on dry ridges or rarely in deep swamps; buds resinous. (p. 126.)..... (NORTHERN) PITCH PINE.

(*c*) Leaves 2 together, rarely 3.

Leaves about 4 inches long; cone less than 2 inches long; young twigs covered with a whitish or pinkish bloom; buds not resinous; large and common trees. (p. 130.)..... SHORT LEAF PINE.

Leaves about 2 inches long; cone $2\frac{1}{2}$ inches long; small trees with curving branches, and thin scaly bark on old trunks. (p. 128.).. JERSEY OR SCRUB PINE.

Leaves about 2 inches long; cone large with stout hooked prickles on the ends of the scales; a rare tree, occurring chiefly along the Blue Ridge. (p. 129.)..... TABLE-MOUNTAIN PINE.

(2) LEAVES FLATTENED, RARELY 1 INCH LONG, SCATTERED SINGLY ALONG THE TWIG; FRUIT NOT A BERRY.

(*a*) Large and common trees of eastern swamps; not evergreen; the end of the twig falling off in the autumn.

Leaves spreading in two rows, one on either side of the twig. (p. 122.)..... CYPRESS.

Leaves, appressed to the twig, in many rows on all sides of it; smaller tree than the above, growing in pine barren ponds..... POND CYPRESS[1].

(*b*) Trees of the mountains; evergreen.

Fruit a small burr or cone, about 1 inch long or less.

Leaves white beneath, in two rows, one on either side of the twig; growing along mountain streams. (p. 134.)..... HEMLOCK.

Leaves scattered on all sides of the twig; scales of the cone larger than the last and spreading; rare trees, chiefly along the Blue Ridge. (p. 135.)..... CAROLINA HEMLOCK.

Fruit a larger, cylindrical cone, 2 to 4 inches long; trees of high mountains.

Leaves green, nearly round, scattered on all sides of the twig. (p. 133.)..... BLACK SPRUCE.

Leaves in one row on either side of the twig, white beneath; trees with white, smooth bark, found on the highest mountains. (p. 136.)..... CAROLINA FIR OR BALSAM.

(3) LEAVES SHORT, SCALE-LIKE, LESS THAN ⅛-INCH LONG; TWIGS OF THE YEAR GREEN.—*Cedars.*

Spray, that is a bunch of twigs, flattened; fruit a small cone; trees of eastern swamps. (p. 119.)..... (JUNIPER. WHITE CEDAR OR

Twigs round; fruit a small, blue berry; (often bearing large, hard, brown excrescences on twigs); dry soil. (p. 121.)..... RED CEDAR.

Twigs, as well as the spray (bunch of twigs) flattened; fruit a small cone; rocky slopes of the Blue Ridge, also extensively cultivated. (p. 119.)..... ARBORVITAE.

II. BROAD-LEAF TREES; TREES WITH LIMBS; LEAVES FROM ¼ OF AN INCH TO 10 INCHES BROAD, CHIEFLY DECIDUOUS.

(1) LEAVES COMPOUND AND PLACED ALTERNATELY ALONG THE TWIG.

(*a*) Leaflets placed alternately along the common leafstem, 7 to 11 in number; flowers white; fruit a dry pod; S. W. mountains; rare. (p. 56)..... YELLOWWOOD.

(*b*) Stout thorns at the base of each leafstem and each leaflet; leaflets dotted with translucent dots; bark warty and thorny; sandy sea coast..... PRICKLY ASH[2].

[1] Taxodium distichum imbricaria (Nuttall) Ashe, Handbook of North Carolina, p. 43 (1896).

[2] Xanthoxylum carolinianum, Lam.

(*c*) Twigs angled, frequently bearing two flattened thorns at the base of each leafstem; leaflets not toothed, opposite on the leafstem, over 11 in number; flowers white; fruit a dry pod; bark furrowed, not thorny. (p. 54.).....YELLOW LOCUST.

(*d*) Twigs round, stout; frequently compound thorns scattered over limbs and trunk; leaves, frequently twice compound, with rather small, toothed leaflets; fruit a long, dark brown, pulpy, many-seeded pod. (p. 56.).....HONEY LOCUST.

(*e*) Twigs sticky or clammy; fruit a dry pod; Macon county, also cultivated; a shrub or in cultivation a small tree. (p. 55.).....CLAMMY LOCUST.

(*f*) Twigs smooth, bearing prominent brown buds; leaflets sharply toothed, smooth; flowers white, small, in large clusters; fruit small, red and berry-like; bruised bark on twigs bitter and scented like cherry bark; highest mountains.....MOUNTAIN ASH[1].

(*g*) Twigs not thorny or sticky; usually from 2 to 4 buds above each leaf-scar; sharply toothed leaflets opposite on leafstem, over 3 inches long, 5 to 13 in number; fruit a nut, with a husk dividing in 4 parts.—*Hickories.*

Leaves and leafstems smooth, not hairy; leaflet 6 to 7: buds scaly.

Leaflets 5, smooth; no resinous particles on lower surface; nut not angled, with a thick shell and thin husk, often pear-shaped; bark not scaly. (p. 88.).....PIGNUT.

Leaflets very large, 5 or 7, smooth, but thickly dotted beneath with resinous particles; twigs, smooth, shining, purple-brown; nut angled, whitish or mealy, rather thin-shelled; the husk greenish-brown, roughened with minute prominencies, often splitting to the base; large trees with shaggy or loose bark; common. (p. 88.).....(HICKORY[2]. RED-HEART OR SMALLNUT

Leaflets 5, smooth; nut white, small, sharply angled, with thin, white shell and thick husk, the fruit globular; bark very shaggy; trees of dry or rocky ridges.....(HICKORY[3]. SMALL OR CAROLINA SHAGBARK

Leaflets 5 to 11, downy or hairy beneath; buds scaly.

Leaflets 5 or 7, soft-velvety beneath; nut with thick husk and thin, white shell; trees with shaggy bark. (p. 86.)....(HICKORY. SHAG OR SCALY-BARK

Leaflets 5 to 9, soft-downy beneath; twigs and buds very stout; nut brown, oblong, thick-shelled; husk thick; large trees of low grounds, with shaggy bark; infrequent.....LARGE SHAGBARK HICKORY[4].

---

[1] Pyrus americana, (Marshall) De Candolle.
[2] Hicoria odorata, (Marshall) Sargent.
[3] Hicoria carolinæ-septentrionalis, Ashe. Notes on the Hickories, Chapel Hill, N. C. (4896.)
[4] Hicoria laciniosa, (Michaux fils) Sargent.

Leaflets 7 to 11, rough-hairy beneath; nut thick-shelled, with thick husk; bark of tree rough but not shaggy. (p. 87.)..... WHITE HICKORY.

Leaflets scurfy beneath with silvery particles; leafstem and midribs hairy; nuts thick-shelled, the husk usually adhering to it; bark very rough; small trees on sandy soil; throughout except high mountains..... SAND HICKORY[1].

Leaflets 7 or more, and leafstem, often smooth; nuts thin-shelled and bitter; husk thin and adhering to the nut; end buds, long, yellow, without scales (naked).

Leaflets 7 to 11, soft-velvety or smoothish beneath; nut large, very thin-shelled and bitter; husk thin. (p. 84.)..... BITTERNUT HICKORY.

Leaflets 9 to 13, smooth; nut small, very thin-shelled and bitter; confined to the lower Cape Fear section. (p. 85.) WATER (BITTERNUT) HICKORY.

(*h*) Leaflets smaller, over 11 in number; fruit a nut with a husk or rind which does not split at all on the mature nut; pith brown, chambered.—*Walnuts.*

Leaflets soft-velvety; fruit nearly round. (p. 83.) BLACK WALNUT.

Leaflets clammy or sticky; fruit oblong. (p. 84.) WHITE WALNUT.

(2) LEAVES COMPOUND AND PLACED OPPOSITE ON THE TWIG.

(*a*) Leaflets 5 or 7, spreading from the same point at the end of the leaf-stem; fruit 2 or 3 brown nuts in a yellow or brownish husk. (p. 47.)..... BUCKEYE.

(*b*) Twigs and buds green and shining: leaflets 3 or 5, coarsely toothed; fruit with 2 wings. (p. 53.)..... BOXELDER.

(*c*) Twigs stout and brown; buds brown and scurfy; fruit with a single wing.—*Ashes.*

(1) The very broad wing entirely surrounding the seed; leaflets 5 to 9, green both sides; eastern. (p. 73.)..... WATER ASH

(2) Fruit narrowly winged at one end only; leaflets 7 to 9.

Leaves whitened beneath; twigs either smooth or velvety. (p. 70.)..... WHITE ASH.

Twigs, buds and green lower surface of leaves velvety; fruit narrowly winged. (p. 72.)..... RED ASH.

Twigs and leaves smooth; leaves bright green beneath, sharply toothed. (p. 73.). GREEN ASH.

(3) LEAVES SIMPLE AND PLACED OPPOSITE ON THE TWIG.

(*a*) Leaves entire, thin, oblong, large, over 2 inches long, downy beneath; flowers, slender, drooping, white; fruit plum-like..... FRINGE TREE[2].

(*b*) Leaves evergreen, thick, smooth, pointed, 3 to 5 inches long; fruit large, 1-seeded; rich hummocks along the coast..... DEVILWOOD OR OLIVE[3].

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[1] Hicoria villosa (Sarg.) Ashe.
[2] Chionanthus virginica, Linnæus.
[3] Osmanthus americanus, (Linnæus) Bentham & Hooker.

(*c*) Leaves toothed, oblong, small, 2 inches long; buds small and acute, or large, round, and flattened from the top; flowers seeming solitary, large and white; fruit a cluster of red berries; twigs purple or green. (p. 63.)..... DOGWOOD.

(*d*) Leaves oblong, 1½ to 3 inches long, toothed or entire-margined; buds, long-stalked, rusty-scurfy; flowers white, small, in flat-topped clusters; fruit black or bluish, containing a seed grooved on the side; small trees or shrubs.....several kinds of..... BLACK HAWS [1].

(*e*) Leaves broader and short, 3 to 5-lobed; fruit with wings.—*Maples.* (The three first frequently grown as shade trees.)

Buds red, blunt; leaves white beneath, generally with 3 shallow lobes; very common; wings of fruit ¾ inch long. (p. 52.)..... RED MAPLE.

Buds red, blunt; leaves white beneath with 3 to 5 lobes; wings of fruit more than 1 inch long; cultivated. (p. 51.)..... WHITE MAPLE.

Buds brown, acute; leaves over 2 inches wide, green or white beneath with 3 lobes, each lobe 3-notched; large trees with rough, hard, shaggy bark; fruit 1½ inch in length. (p. 50.)..... SUGAR MAPLE.

Leaves as in the sugar maple, but only half the size; fruit less than one inch long; small trees with smooth gray bark, branching near the ground; rocky river banks in the counties drained by the Yadkin and Catawba rivers..... WHITE-BARK MAPLE [2].

Small trees of the high mountains, above 3,000 feet, with striped branches, green twigs and large, smooth, 3-lobed leaves; long, stalked, purplish buds. (p. 49.).. STRIPED MAPLE.

Small trees of the highest mountains, over 4,000 feet, with purplish twigs and 3-lobed leaves, velvety beneath. (p. 48.)..... MOUNTAIN MAPLE.

(4) LEAVES SIMPLE AND ALTERNATE OR SCATTERED ALONG THE TWIG.

(*a*) Leaves mostly rather large, 3 or more inches long, nearly as broad as long, more or less heart-shaped.

(1) Small trees; leaves smooth and with entire edges; fruit a pod; flowers in early spring, bright red. (p. 57.)..... REDBUD.

(2) Larger trees, with leaves triangular, smoothish, finely toothed on the margins; buds resinous when crushed.—*Cottonwoods.*

Trees of eastern swamps; leaves

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[1] Species of Viburnum.
[2] Acer leucoderme, Small, Bul. Tor. Bot. Cl., xxii, p. 367.

finely toothed; leafstem flat; twigs angled. (p. 118.) ..... COTTONWOOD.

Trees of lowgrounds, eastern and middle sections; leaves finely toothed; leafstem round. (p. 118.) .. CAROLINA COTTONWOOD.

Trees on dry slopes of the Blue Ridge; leaves, about 2 inches long, coarsely toothed; leafstem flattened. (p. 117.) ..... ASPEN.

(3) Mostly trees on the mountains or cool banks; flowers white, in early summer; fruit a small, dry berry; leaves sharply toothed; twigs with large buds and inodorous bark.—*Lins or Lindens.*

Leaves thin and nearly smooth, green both sides; found chiefly around high mountains. (p. 42.) ..... BASSWOOD.

Leaves thickish and white beneath. (p. 45.) ..... LIN.

Leaves thickish, velvety beneath; found chiefly on cool hummocks near the coast. (p. 44.) ..... SOUTHERN LIN.

(4) Small trees of rich woodland; bark ill-scented when broken; fruit, ripening in summer, a black, edible berry; often cultivated. (p. 79.) ..... MULBERRY.

(*b*) Leaves about as broad as long, 2 to 5 inches long, not heart-shaped in outline; buds scattered; large and common trees except last.

Leaves large, with a broad notch at the top, lobed on the sides; large buds flattened; in rich woods and along streams. (p. 39.) .. TULIP-TREE OR YELLOW POPLAR.

Leaves small, deeply 5-lobed: crushed buds resinous scented; twigs often with corky wings; fruit a rough ball, about 1 inch in diameter hanging by a stem 2 to 3 inches long. (p. 61.) ..... SWEET GUM.

Leaves 3 to 5-lobed, white beneath with soft wool; leafstem covering the bud; trunk of tree smooth and whitish above; fruit a rather smooth ball, about 1 inch in diameter, hanging by a slender stem; mostly along streams. (p. 81.) ..... SYCAMORE.

Leaves with sharp spines along their edges, thick, evergreen, dark green; trees with smooth gray bark. (p. 46.) ..... HOLLY.

(*c*) Leaves large, 4 to 30 inches long, oblong in outline, not toothed or lobed; flowers large and white.—*Magnolias.*

Leaves thick, evergreen, over 6 inches long, brown-hairy beneath; Brunswick county, and frequently cultivated. (p. 33.) ..... MAGNOLIA. EVERGREEN

Leaves smaller, white beneath; bark white and smooth; buds silky; eastern swamps ..... WHITE BAY.

Leaves 4 to 6 inches long, greenish beneath; bark furrowed; buds silky-hairy; mountains ..... CUCUMBER TREE.

Leaves large, 10 to 30 inches long; buds silky; rare; western. (p. 36.).....GREAT-LEAVED MAGNOLIA.

Leaves 10 to 15 inches long, with a deep notch at the bottom, often collected at the end of the twig; buds not hairy; high mountains. (p. 38.).....WAHOO OR MOUNTAIN MAGNOLIA.

Leaves 10 to 20 inches long, pointed at each end, collected at the ends of the twigs; along streams. (p. 37.).....UMBRELLA TREE.

(*d*) Leaves longer than broad, 2 to 8 inches long; twigs mostly brown, with from 2 to 5 buds crowded at the top, other buds scattered below; fruit an acorn, i. e. a nut with the base enclosed in a scaly cup.—*Oaks.*

(1) Leaves not at all lobed or toothed, except on vigorous shoots, wedge-shaped or triangular or long and narrow in outline; leafstems short.—*Water Oaks and Willow Oaks.*

*1) Leaves green on both sides.

Leaves 4 to 6 inches long, triangular in outline, thick; buds large; twigs thick; acorn large, ¾ inch wide; small trees; bark rough, black. (p. 103.).....BLACK-JACK OAK.

Leaves narrowly triangular, 2 to 3 inches long; twigs slender; buds small and blunt; nut small; trees with smoothish gray bark; eastern. (p. 105.).....WATER OAK.

Leaves very narrow, pointed; twigs slender; in the middle and eastern parts of the State, usually in wet places. (p. 108).....WILLOW OAK.

Leaves paler beneath and downy; banks of streams along the Blue Ridge and to the westward. (p. 107).....SHINGLE OAK.

*2) Leaves whitened beneath, 2 to 5 inches long; extreme east.

Leaves very narrow; acorn small, globose, whitened; small trees on dry sandy soil. (p. 107.).....(WILLOW OAK. BARREN OR UPLAND

Leaves broader, evergreen; large trees, on the coast, with a long acorn. (p. 96.).....LIVE OAK.

(2) Leaves more or less lobed, the divisions tipped with a bristle.—*Red Oaks and Black Oaks.*

*1) Leaves with a leafstem less than 1 inch long.

Leaves broad, 3-lobed at the top. (p. 103.).....BLACK-JACK OAK.

Leaves narrow, ½ to 1 inch broad, with shallow lobes; on the sea coast. (p. 106.).....LAUREL OAK.

Leaves about 2 inches wide with 3 lobes at the top or shallow lobes on the sides; mountains.....LEA'S OAK[1].

Leaves green and smooth on both sides with many long, often curved

[1] Quercus leana, Nuttall.

lobes; acorn large; cup with coarse, spreading scales; small trees with rough, gray bark; on pine barrens. (p. 102.)..(JACK OR SAND OAK. FORK-LEAF BLACK.

*2) Leaves with a long and slender leaf-stem, 1 to 3 inches long, green beneath.

Leaves over twice as long as broad, the lobes acute; rare; middle section.....BARTRAM'S OAK[1].

Leaves broader, generally not twice as long as broad with many lobes on each side; large trees.

?) With deep and rounded hollows between the lobes of the leaves; large trees.

Light gray bark on limbs: nut half covered by the cup; common on dry, stiff or gravelly soils; twigs brownish. (p. 99.).....SCARLET OAK.

With dark gray bark on branches; only base of nut covered by the cup; rare; along streams of the middle counties; twigs steel-gray. (p. 98.)..TEXAS RED OAK.

?) With shallower, acute hollows between the lobes of the leaf.

Leaves downy beneath; cup covering half of the large nut; bark rough and black. (p. 101.).....BLACK OAK.

Leaves smooth beneath; cup very shallow; bark striped, dark, and light gray; western. (p. 97.).....(NORTHERN) RED OAK.

*3) Leaves whitened beneath; leafstem slender; nut small, globular. (p. 103.).....SPANISH OAK.

(3) Leaves more or less lobed or toothed, the divisions rounded and not bristle-tipped; leafstems less than 1 inch long; bark gray, furrowed or shaggy.—*White Oaks and Chestnut Oaks.*

Leaves deeply 5 to 9-lobed; nut nearly covered by the cup; in the eastern swamps. (p. 92.).....OVERCUP OAK.

Leaves deeply 5 to 7-lobed; cup one-half the length of the acorn; small trees, common on dry soil. (p. 91).....POST OAK.

Leaves 7 to 9-lobed; cup of acorn shallow; large trees; light gray bark; common. (p. 89.).....WHITE OAK.

Leaves thick with many, rounded, shallow lobes; bark deeply furrowed; dry soil; western; acorn very large. (p. 93.).....ROCK CHESTNUT OAK.

Leaves thin, velvety beneath, with many rounded, shallow lobes; bark shaggy; swamps and river banks eastward. (p. 95.).....SWAMP CHESTNUT OAK.

(e) Leaves more than 3 inches long, sharply toothed on the sides and with prominent,

[1]Quercus heterophylla, Michaux.

straight veins; buds scattered along the twig, as are the leaves.

(1) Buds oblique to the axis of the twig; fruit edible, brown nuts enclosed in a prickly burr.

Leaves over 6 inches long, green both sides. (p. 109.) ..... CHESTNUT.

Leaves about 4 inches long, white-downy beneath ..... CHINQUAPIN[1].

(2) End bud long and slender, silky, brown; twigs unpleasant scented; leaves about 10 inches long; fruit when ripe yellow and pulpy. (p. 41.) ..... PAPAW.

(*f*) Leaves about 4 inches long, veins not straight and prominent, evergreen, thick, smooth, dark green, irregularly toothed, sharply pointed; flowers large, white; fruit a woody capsule; small tree of eastern swamps with a straight trunk, not forking and narrow, conical top. (p. 42.) ..... LOBLOLLY BAY.

(*g*) Leaves generally less than 3 inches long (with exceptions under ¶¶ 1 and 2), and scattered along the twig as are the buds.

(1) LEAVES NOT TOOTHED ON THE MARGIN, 2 TO 5 INCHES LONG.

Leaves and twigs aromatic; fruit a deep blue berry on a red stalk.

Leaves evergreen, thick, dark green, hairy beneath, as is the brownish twig; eastern swamps. (p. 94.) ..... RED BAY OR SWEET BAY[2].

Leaves as in the above, but smooth beneath, as are the twigs; sandy sea coast ..... SMOOTH RED BAY.

Leaves often 2 or 3-lobed; bark aromatic: fields and fence rows; twigs green ..... SASSAFRAS.

Leaves and twigs not aromatic; fruit various.

Leaves thickish, smooth, evergreen, narrowed at the base; fruit many small capsules; small trees or shrubs with smooth, thin, brown bark; eastern swamps. (p. 47.) ..... CYRILLA.

Leaves 2 to 4 inches long; bark not aromatic; fruit a small blue berry; common throughout the State. (p. 63.) ..... BLACK GUM.

Leaves 4 to 6 inches long; rarely coarsely toothed; fruit a blue berry ¼ inch long; deep eastern swamps. (p. 65.) ..... TUPELO GUM.

Leaves about 2 inches long, thick, evergreen, pointed; flowers white; fruit a black one-seeded cherry; twigs bitter; Smith's Island ..... MOCK ORANGE[3].

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[1] Castanea pumila, Linnæus.

[2] Persed borbonia pubescens (Pursh) nom. nov.: P. pubescens, Sargent, Sylva, vii, p. 7 (1895).

[3] Prunus caroliniana, (Miller) Aiton.

Fruit when ripe roundish, yellow, pulpy and edible; astringent when green, the 4-lobed calyx persistent at its base; seed several, flat; fields. (p. 68.).....PERSIMMON.

(2) LEAVES LOBED, OR TOOTHED ON THE MARGIN.

Fruit pulpy or fleshy, as in apple or cherry.

Leaves often lobed; twigs armed with stout thorns; fruit a small sour apple one inch in diameter, yellow when ripe; flowers pink, sweet-scented. .....2 kinds of.....CRAB APPLE[1].

Leaves variously lobed or toothed, twigs often armed with long slender thorns; buds very small; flowers white, about ½ inch in diameter in large, flat-topped clusters, in spring; fruit, berry-like, orange or red, in clusters; small trees with bark of trunk scaly or pealing off in thin sheets or scaly.....several kinds of.....RED (HAW) THORN[2].

Leaves silky-hairy beneath; the edible red fruit small and berry-like; bark smooth and white. (p. 60.).....SERVICE TREE.

Bark of trees bitter to taste; leaves smooth, finely and sharply toothed; fruit one-seeded.

Fruit a black cherry; flowers in a drooping raceme at the end of the twig; frequent. (p. 59.).....WILD BLACK CHERRY.

Fruit a red cherry; flowers in slender, long stemmed clusters along the sides of the twig; occurs only on highest mountains. (p. 58.).....WILD RED CHERRY.

Flowers in long-stemmed clusters along the sides of twig; fruit red or yellow when ripe, about ½ inch long; seed flattened; small trees, sometimes with thorny branches; fields, waste places or along streams..... .....2 kinds of.....WILD PLUM[3].

Bark of tree often with corky outgrowths; fruit a small 1-seeded sweet berry; leaves thin and nearly smooth, tapering to a sharp point, unequal sided; chiefly along streams. (p. 80.).....HACKBERRY.

Fruit various, either a nut or dry.

A. Leaves over three times as long as broad.

Leaves green beneath and not hairy, finely toothed, long and narrow, ¼ to ½ inch broad; twigs brittle, yellow or red; common along streams and wet places, except in the coastal plain where it is largely replaced by the next. (p. 116.).....BLACK WILLOW.

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[1] Pyrus coronaria, Linnæus and C. angustifolia, Aiton.
[2] Species of Cratægus.
[3] Prunus americana, Marshall and P. angustifolia, Marshall.

Like the above, but the larger leaves, though smooth, whitened beneath; eastern.....WARD WILLOW[1].

Leaves whitened beneath with a fine down, at least when young; later smooth but white; twigs mostly red and purple; small slender trees, along streams, chiefly western and central.....GLAUCOUS WILLOW[2].

Twigs with no bud at the end, tipped by a hard point or white flowers or fruit; leaves 3 to 4 inches long, finely toothed, smooth, acid when chewed. (p. 66.).....SOURWOOD.

A. Leaves less than three times as long as broad.

Terminal bud over ½ inch long; fruit a 3-angled nut, bark of trunk smooth, light gray; leaves straight-veined. (p. 111.).....BEECH.

Small trees with smooth, light gray bark, fluted trunk, beech-like leaves and hop-like clusters of fruit; bud short; very common along streams. (p. 113.).....HORNBEAM.

Leaves 3 to 4 inches long, sharp-pointed, downy beneath, as is the leafstem; flowers, white, bell-shaped, in drooping clusters; fruit about ½ inch long, 3-angled, the angles winged; usually small trees with striped green and brown branches; along streams and cool hollows in the mountains. (p. 70.).....SNOWDROP-TREE.

Bark of small limbs peeling off in thin papery layers; flowers in catkins in spring; fruit cylindrical in shape, 1 inch long, covered with green bracts, each with a seed at its base within.—*Birches.*

Layers of bark red or pinkish; leaves pale beneath; common along streams. (p. 114.)....RIVER BIRCH.

Layers of bark silvery white; trees of highest mountains; leaves green beneath. (p. 113.).....YELLOW BIRCH.

Bark of twig having the taste of wintergreen (or peppermint) when chewed; flowers and fruit of the above; trees of cool mountains. (p. 115.).....SWEET OR CHERRY BIRCH.

The remaining native forest trees all have have small leaves. from 1 to 2 inches long long, green both sides and finely and sharply toothed. They are either *elms* or elm-like in the appearance of their foliage, and it is difficult to give accessible leaf-characters for their identification.

Twigs yellowish or light brown; buds minute, sometimes clustered; fruit a small scaly nut; bark smooth, dark gray; confined to the lower Cape Fear section.....PLANER TREE[3].

Fruit in hop-like clusters; small

[1] Salix longipes wardii (Bebb) nom. nov.; S. nigra wardi, Bebb, Bul. U. S. Nat. Mus. No. xxii, p. 114.
[2] Salix discolor, Muehlenburg.
[3] Planera aquatica, Gmel.

trees, with shaggy, brown bark, growing on rich hillsides; western. (BEAM OR IRONWOOD. (p. 112.)..... HOP-HORN-

Remaining large trees; fruit a winged seed falling in spring before the leaves appear; extensively cultivated for shade trees. —*Elms.*

Twigs very hairy; the leaves broadly oval, rough and hairy; twigs gummy when chewed; infrequent. (p. 78.)..... SLIPPERY ELM.

Twigs smoothish; leaves over 2 inches long, but slightly rough; bark on large trees mostly scaly. (p. 76.)..... WHITE ELM.

Twigs smoothish; the leaves about 2 inches long; bark on large trunks firm and furrowed; the bark of twigs often corky winged. (p. 77.)..... WINGED ELM.

III. PALMS; TREES WITHOUT LIMBS; lmited in this State to the PALMETTO, a small tree with unbranched stem about 10 inches in diameter and a small crown of evergreen leaves two feet or more in breadth; found only along the coast to the south of Cape Hatteras. (p. 136.)..... PALMETTO.

TIMBER TREES OF NORTH CAROLINA

BY.

GIFFORD PINCHOT

TIMBER TREES OF NORTH CAROLINA

By Gifford Pinchot

Magnolia fœtida, Sargent.*

(MAGNOLIA.)

A large pyramidal tree, with gray or light brown bark covered with small thin scales, reaching a height of 90 and a diameter of 4½ feet.

It occurs southward from the mouth of the Cape Fear river, rarely more than fifty or sixty miles from the coast, to Mosquito inlet and Tampa bay, Florida; along the Gulf coast to the valley of the Brazos river, Texas; in western Louisiana and southern Arkansas, and on the bluffs of the lower Mississippi, where it reaches its best development.

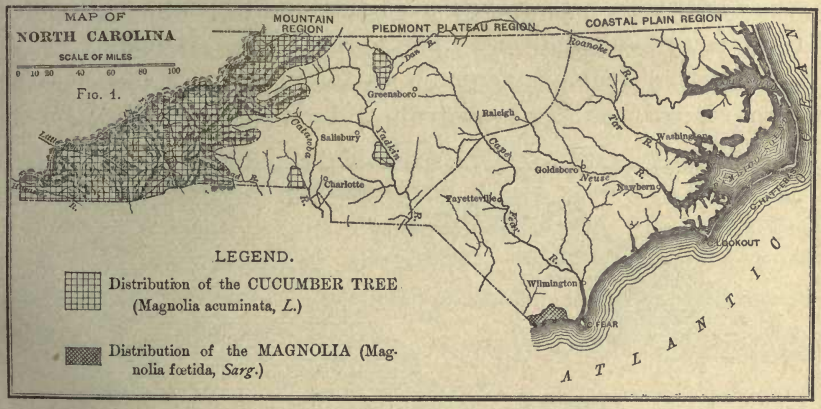


FIG. 1.

In North Carolina, where it grows to an average height of 50 to 70 feet, it is found rather sparingly in Brunswick county, in the southeast corner of the State (fig. 1), growing in the rich, moist soil of river swamps.

It reproduces itself rather slowly in the latitude of this State,

*Magnolia grandiflora, Linnæus.

and young seedlings are very rarely found in the forest, although the tree flowers and matures fruit not only regularly but, for the most part, abundantly as well.

The long thick leathery evergreen leaves are downy underneath, and remain upon the tree for two years. The fragrant creamy-white flowers are very large and conspicuous, often 7 or 8 inches across. The oval fruit is rusty brown in color, 3 to 4 inches long by 1½ to 2½ inches broad. The winter-buds are thickly covered with dark rusty hairs. The roots, finely divided, penetrate the soil to a moderate depth.

The wood is moderately hard, close-grained, not strong, easily worked, not durable in contact with the soil, and is as valuable as that of the other magnolias; creamy-white in color; the thick sapwood nearly white. Although well suited for cabinet work and interior finish, the wood is little used except for fuel.

Magnolia glauca, Linnæus.

(WHITE BAY. SWEET BAY. SWAMP BAY.)

A slender tree, with gray branches and light brown small-scaled bark, reaching a height of 70 and a diameter of 3½ feet.

It occurs in deep, wet swamps as far north as Massachusetts, where it is reduced to a low shrub, and extends from New Jersey

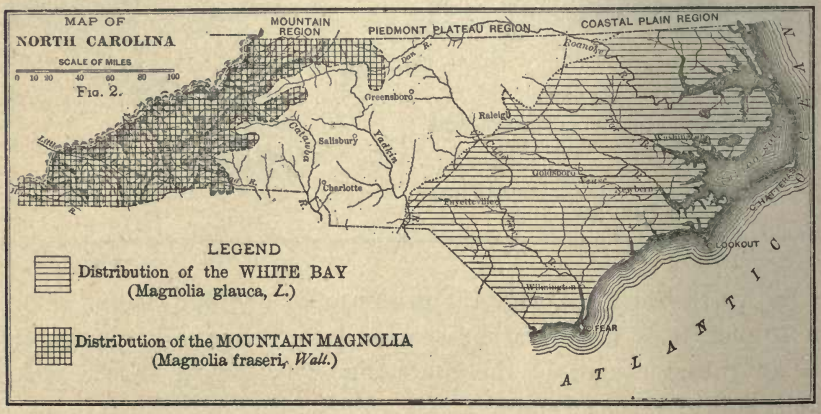


Fig. 2.

southward, generally near the coast, to Florida, where it reaches its best development, and southern Texas. It is not found in the

Appalachian mountains. In the South Atlantic and Gulf states it forms, with the loblolly bay and red bay, low, almost impenetrable thickets on the borders of pine barren ponds and shallow swamps, and reaches its best development in the interior of Florida.

In North Carolina, where it attains an average height of 12 to 25 feet, it is confined to wet lands or the margins of bodies of fresh or salt water in the eastern part of the Piedmont plateau and in the coastal plain region (fig. 2, p. 34), although not common in the former. In the coastal plain region there are two well-marked forms, dependent upon the quality of the soil; one, a tree of some size, the other rarely over 10 feet in height. With the white cedar it forms a large part of the growth of the "juniper bays." Sometimes after the white cedar has been cut, and usually after these swamps have been burned, thickets of this bay appear.

Seed is borne abundantly every year. The rate of growth is fairly rapid, especially in youth. Trees of all ages sprout freely from the stumps, and shoots usually appear after a tree has been killed by fire.

The oblong leaves, which are pale green above and white beneath, are partly deciduous in this State, especially toward the Piedmont plateau. The pure white fragrant flowers bloom in May, and the dark red fruit is oval, smooth, 2 inches long, and 1½ inches broad. The winter-buds are thickly covered with fine hairs. The tree has a superficial root system.

The wood is soft, light, close-grained, and not strong; light brown in color; the thick sapwood creamy-white. It is occasionally used for broom handles and woodenware. A tonic and diuretic is obtained from the bark.

Magnolia acuminata, Linnæus.

(CUCUMBER TREE.)

A tall slender tree, with furrowed dark brown bark broken into numerous thin scales, reaching a height of 90 and a diameter of 5 feet.

It occurs from western New York through southern Ontario to

southern Illinois, and southward along the Appalachian mountains to southern Alabama and northeastern Mississippi. It grows sparingly in central Kentucky and Tennessee, and in portions of Arkansas, and reaches its best development in the mountains of Tennessee and the Carolinas.

In North Carolina, where it attains an average height of 60 to 80 feet and an average diameter of 3 to 4 feet, it is found on moist, fertile soil in the mountains, and rarely as far to the east of the mountains as Stanly county. (Fig. 1, p. 33.) Seed is produced frequently but seldom abundantly. Though young seedlings are common, many of them are quickly crowded out by other species when the mature trees are removed. Smaller trees sprout from the stump to a limited extent. The rate of growth is rapid.

The rather broad, pointed leaves are bright green above and slightly paler below. The yellowish-green flowers appear towards the latter part of May, and the dark red fruit is oblong, 2½ to 3 inches long by 1 inch broad. The winter-buds are densely covered with silky white hairs.

There are numerous deep lateral roots and, rarely, a taproot.

The wood is soft, satiny, light, not strong, close-grained and durable; light yellow-brown in color; the thin sapwood often nearly white. It is used for water pipes, troughs, flooring and cabinetmaking. This tree has been cut to a large extent in most of the mountain counties except Alleghany, Graham, Mitchell, Clay, Watauga, Yancey, Macon, and Swain.

Magnolia macrophylla, Michaux.

(GREAT-LEAVED MAGNOLIA.)

A spreading tree, with thin smooth, light gray bark divided into minute scales, reaching a height of 50 feet and a diameter of 20 inches.

It occurs from the sheltered valleys about the base of the Alleghany mountains of North Carolina and southeastern Kentucky, to middle and western Florida and southern Alabama, and through northern Mississippi to the valley of the Pearl river in Louisiana,

and in central Arkansas, reaching its best development in northern Alabama.

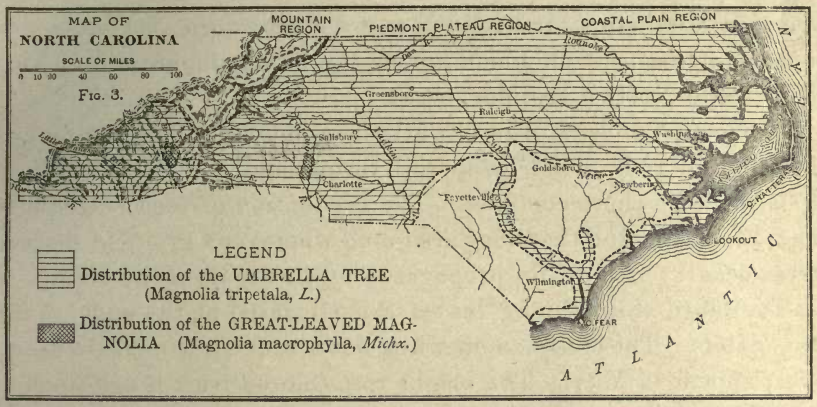


Fig. 3.

In North Carolina, where it attains a height of 15 to 30 feet, it is found in Lincoln county and to some extent on the French Broad river about Asheville. (Fig. 3.)

It bears seed in large quantities at frequent intervals. Few years pass without some mast. Young seedlings are, however, uncommon in the dense woods. Young trees sprout vigorously when cut.

The leaves are very large, from 20 to 30 inches long and 9 to 10 inches broad, and are clustered at the summit of the branches. The white fragrant flowers are also large, and the bright rose-colored fruit is broadly egg-shaped and 2½ to 3 inches long. The large winter-buds are covered with thick silky white hairs. There are strong lateral and numerous fibrous roots.

The wood is hard, close-grained, light, and not strong; light brown in color; the thick sapwood light yellow. It has no commercial value.

Magnolia tripetala, Linnæus.

(UMBRELLA TREE.)

A small tree, with irregular branches, and smooth, light gray bark marked with numerous small blister-like excrescences, reaching a height of 40 feet and a diameter of 18 inches.

It occurs along the Appalachians from Pennsylvania to central Alabama, and extends in the south Atlantic states nearly to the coast, and westward to middle Kentucky, Tennessee and northwestern Mississippi, and central and southwestern Arkansas. It reaches its best development among the Smoky mountains of Tennessee and North Carolina.

In North Carolina, where it attains a height of 25 to 35 feet, it is found on rich, moist, deep soil throughout the State (fig 3, p. 37), but is nowhere common. The production of seed is frequent and abundant, and seedlings are found wherever a group of mature trees occur. It is easily propagated by shoots from the stump.

The large thin, oblong leaves are clustered at the ends of the branchlets. The conspicuous white flowers, about 5 inches in diameter, appear in May. The bright rose-colored fruit is egg-shaped, 3½ to 4 inches long. The large purple winter-buds are covered with a whitish bloom.

The wood is light, soft, weak, close-grained; brown in color; the heavier sapwood creamy-white. It has no commercial value.

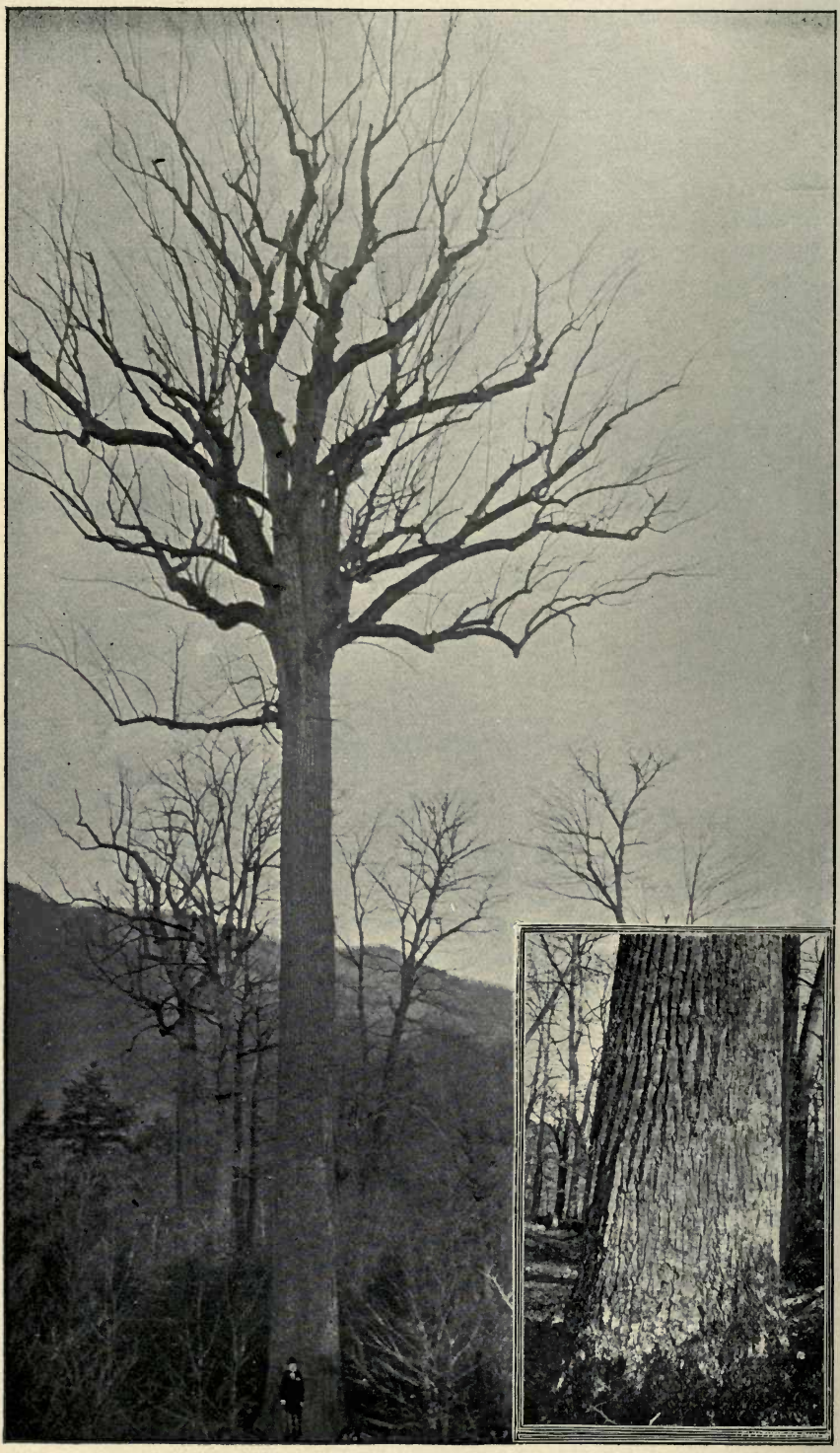
Magnolia fraseri, Walter.

(MOUNTAIN MAGNOLIA. WAHOO. INDIAN BITTERS.)

A slender tree, with regular and wide-spreading or contorted branches, and dark brown, smooth or minutely scaled bark. It reaches a height of 40 feet and a diameter of 18 inches.

It occurs from the mountains of southwestern Virginia to southern Alabama and western Florida, and westward through east Tennessee and northern Mississippi to the valley of the Pearl river. It grows in the valleys of mountain streams, and reaches its best development on the tributaries of the Savannah river, and on the slopes of the Black and Big Smoky mountains. Locally abundant, it is the least widely distributed of the American magnolias.

In this State it occurs in all the counties west of the Blue Ridge and in the western parts of those immediately east of it. It is most common in Ashe, Mitchell, Yancey, Swain, Macon, Transylvania, and Burke counties. (Fig. 2, p. 34.)



YELLOW POPLAR

Seed is produced nearly every year and young seedlings are abundant in the woods. Cattle are very fond of the young plants. Old trees are apt to be hollow at the butt and not uncommonly throughout the trunk.

The large leaves, which are crowded at the end of the branchlets, are smooth, glossy, pointed at the apex and eared at the base. When fully expanded the beautiful cream-colored flowers often measure 8 or 9 inches across. The bright rose-colored fruit is oblong, 4 to 5 inches in length and 1½ to 2 inches broad. The large winter-buds are purple.

The wood is light, soft, weak, close-grained; light brown in color; the thick sapwood creamy-white. It has no commercial value.

Liriodendron tulipifera, Linnæus.

(YELLOW POPLAR. TULIP TREE. WHITEWOOD.)

A large tree of the first commercial value, with a small pyramidal head and brownish-gray bark, reaching a height of 190 and a diameter of 10 feet. The trunk is straight and cylindrical, and in the largest specimens often free from branches to a height of from 80 to 100 feet. (Plate II.)

It occurs from Rhode Island to southwestern Vermont, west to the southern shores of Lake Michigan, and south to northern Florida, southern Alabama and Mississippi, and southeastern Missouri and the adjacent parts of Arkansas; reaching its best development on the tributaries of the Ohio and the lower slopes of the high mountains of North Carolina and Tennessee. It grows habitually in deep, rich, moist soil. Although widely distributed, it is seldom the predominant tree in the forest.

In North Carolina, where it reaches an average height of 60 to 100, and an average diameter of 3 to 4 feet, it is found in all parts of the State. (Fig. 4, p. 40.) In the coastal plain it occurs on fertile soil with sweet gum, black gum, swamp chestnut oak, and water oak, or on peaty soil with the white cedar (juniper).* Throughout this section the trees are apt to be hollow; there is a larger amount of sapwood, and the timber is inferior in quality to that in the middle and western sections. In the Piedmont pla-

*Chamæcyparis thyoides, L.

teau it is found in ravines and on north hillsides, and is largely used for cabinetmaking and interior woodwork. It is most abundant, attains its greatest size, and forms its finest timber on the

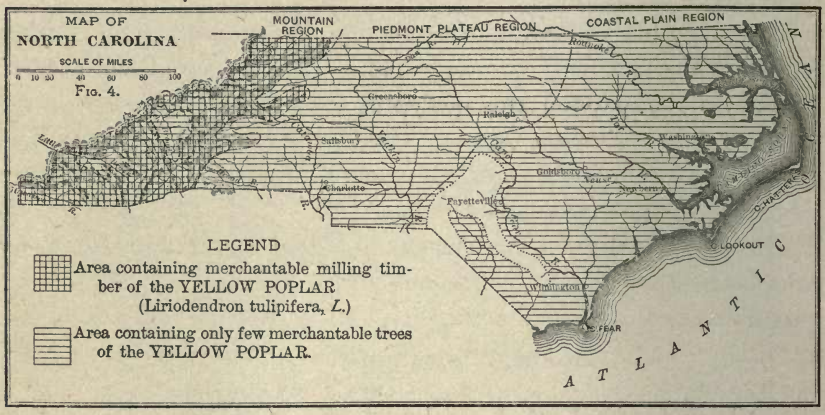


Fig. 4.

lower mountain slopes in the counties west of the Blue Ridge, where trees 8 to 10 feet in diameter and more than 150 feet high are occasionally found. Throughout this region it is the chief building material.

Trees growing in the open mature seed in abundance nearly every year; forest trees less frequently. Young seedlings are common in the woods and grow rapidly if not heavily shaded. Cattle eagerly devour young plants. Although trees over four feet in diameter are often hollow at the butt, it is uncommon to find the trunk unsound throughout. The quality of the timber is seldom injured by wind shakes.

The leaves are smooth, bright green, 4-lobed, with a deep rounded incision on either side and a broad shallow notch at the apex. The greenish-yellow tulip-shaped flowers appear in May, and the fruit is a narrow, light brown cone. The dark reddish winter-buds are covered with a whitish bloom.

The wood is light, soft, brittle, not strong, close and straight-grained, easily worked, and does not split or shrink easily; yellow or brown in color; the thin sapwood creamy-white. The yellow poplar is one of the most useful, as well as one of the largest, of American deciduous trees. It is largely used for construction, inte-

rior finish, boat building, shingles, pumps, and woodenware. A tonic and stimulant is made from the inner bark of the root.

Large quantities of poplar have been sawed in the last few years in eastern North Carolina and used in the manufacture of crates, trucking boxes, etc., but there is still a great deal of timber standing in the counties north of the Neuse river. The merchantable poplar has been cut for the most part in the midland counties. It has been estimated that about 500,000,000 feet of merchantable yellow poplar is standing in the mountains of western North Carolina. This is principally in Ashe, Alleghany, Watauga, Mitchell, Yancey, Haywood, Transylvania, Swain, Graham, and Macon counties. Asheville is the chief seat of the manufacture of poplar lumber; a great deal is manufactured also at Dillsboro, Magnetic City, and Cranberry. Between 12,000,000 and 13,000,000 feet of poplar was sawed for shipment during 1892 in the counties west of the Blue Ridge, and half as much more for local use.

Asimina triloba, Dunal.

(PAPAW.)

A shrub or low tree, with slender spreading branches and dark brown bark marked with large ash-colored blotches, sometimes reaching a height of 40 and a diameter of 1 foot.

It occurs from western New York and the northern shores of Lake Ontario, southward to central and eastern Pennsylvania, westward to southern Michigan, southern Indiana and eastern Kansas, and south to middle Florida and eastern Texas. It is comparatively rare toward the Atlantic seaboard, but very common in the Mississippi valley, reaching its best development along the tributaries of the lower Ohio river and the streams of central and southern Arkansas, where it grows in deep rich and rather moist soil, sometimes to the exclusion of other trees.

In North Carolina it occurs in all parts of the State, and is most abundant in the northeastern and middle sections on somewhat swampy or alluvial lands, where it reaches an average height of from 10 to 15 feet. It is rare in the sand barrens of the south-

eastern part, and altogether wanting in the high mountains. It reproduces itself freely.

The large deciduous leaves are sharp pointed at the apex and contracted at the base. The flowers, which are nearly 2 inches across, are a dull deep red at maturity. The edible fruit is dark brown, almost black, oblong, rounded, 3 to 5 inches long by 1 to 1½ inches broad, and from 6 to 12 ounces in weight.

The pointed winter-buds, ⅛ of an inch in length, are covered with rusty brown hairs.

The wood is light, soft, weak, coarse-grained, spongy, with the annual layers clearly marked; light yellow in color; the thin sapwood somewhat lighter.

Gordonia lasianthus, Ellis.

(BAY. BULL BAY. LOBLOLLY BAY.)

A medium size tree, with a narrow, compact head, and dark red-brown scaly bark, broken into regular shallow furrows and parallel rounded ridges. It reaches a height of 75 and a diameter of 2 feet; or is rarely a low shrub.

It occurs from the southern part of Virginia to southern Florida and westward to the valley of the Mississippi river. It is most common in Georgia and eastern Florida, reaching its best development in damp situations.

In North Carolina it occurs in the coast region, where it reaches a height of 50 to 70 feet, and a diameter of 18 to 24 inches.

It bears some seed nearly every year, and full seed years are frequent. Young seedlings are common throughout the range of the species.

The thick dark evergreen leaves are oblong, pointed at the apex and narrowly contracted at the base. The fragrant white flowers appear late in summer; and the fruit is a woody, egg-shaped capsule. The narrowly pointed winter-buds are covered with pale silky hairs.

The wood is light, soft, close-grained, not strong or durable;

light red in color; the thick sapwood lighter. It is occasionally used for cabinetmaking; and the bark has been locally employed in tanning.

Tilia americana, Linnæus.

(BASSWOOD. LIN. LINDEN.)

A tall tree, with slender, often pendulous branches, and thick, furrowed, light brown bark covered with small, thin scales. It reaches a height of 130 and a diameter of 4 feet.

It occurs in rich soil from northern New Brunswick to the southern shore of Lake Winnipeg, and southward through the Atlantic states to Virginia, along the Appalachian mountains to Alabama and Georgia, and to eastern Texas. It reaches its best develop-

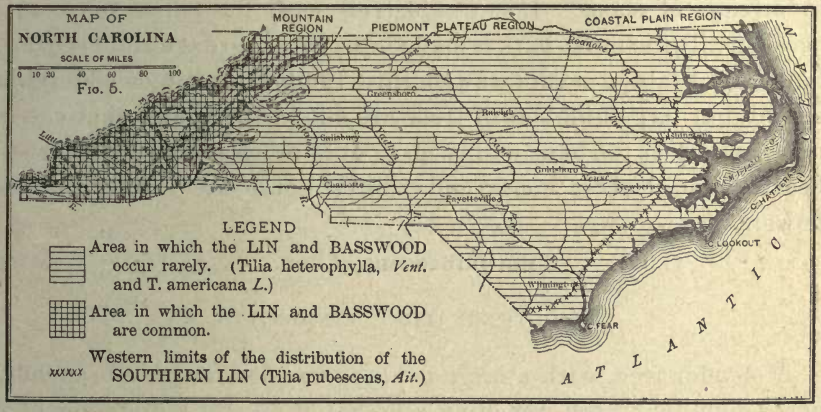


FIG. 5.

ment along the northern tributaries of the lower Ohio river. One of the most common trees of the northern forest, it formerly occupied exclusively large tracts of the richest land.

In North Carolina, where it attains a height of 50 to 80 and a diameter of 1 to 4 feet, it is found more or less widely distributed in the mountains and in the upper part of the Piedmont plateau along the slopes of mountain spurs and higher hills, while in the lower Piedmont and coastal plain regions it is found sparsely distributed as a smaller tree. (Fig. 5.)

Basswood bears seed very abundantly every 2 or 3 years. The young growth is eagerly devoured by cattle. Specimens over 2

feet in diameter are usually hollow at the butt and not uncommonly through the entire stem. Stumps of trees which have been cut or blown down sprout vigorously. Windfalls are frequent.

The large thick roundish leaves are sharp-toothed, narrow-pointed at the apex, and unevenly heart-shaped at the base. The clusters of small white flowers are borne on an oblong, leaf-like bract, and the fruit is egg shaped, about ¼ inch in length and covered with short gray wool. The dark red winter-buds are stout, egg-shaped, and pointed. The root system is a network of strong lateral roots.

The wood is soft, straight-grained, not durable; light brown in color; the thick sapwood hardly distinguishable. It is largely used for lumber, and, under the name of whitewood, in the manufacture of woodenware and furniture, for carriage-making, and for the inner soles of shoes. It is extensively used for paper pulp, and occasionally the inner bark is made into coarse cordage and matting.

In this State it is not sawed into lumber to any considerable extent, but large numbers of trees are cut in the winter that cattle may feed upon the buds and twigs. It is much prized by apiarists because the clearest honey and whitest comb are made from its flowers.

Tilia pubescens, Aiton.

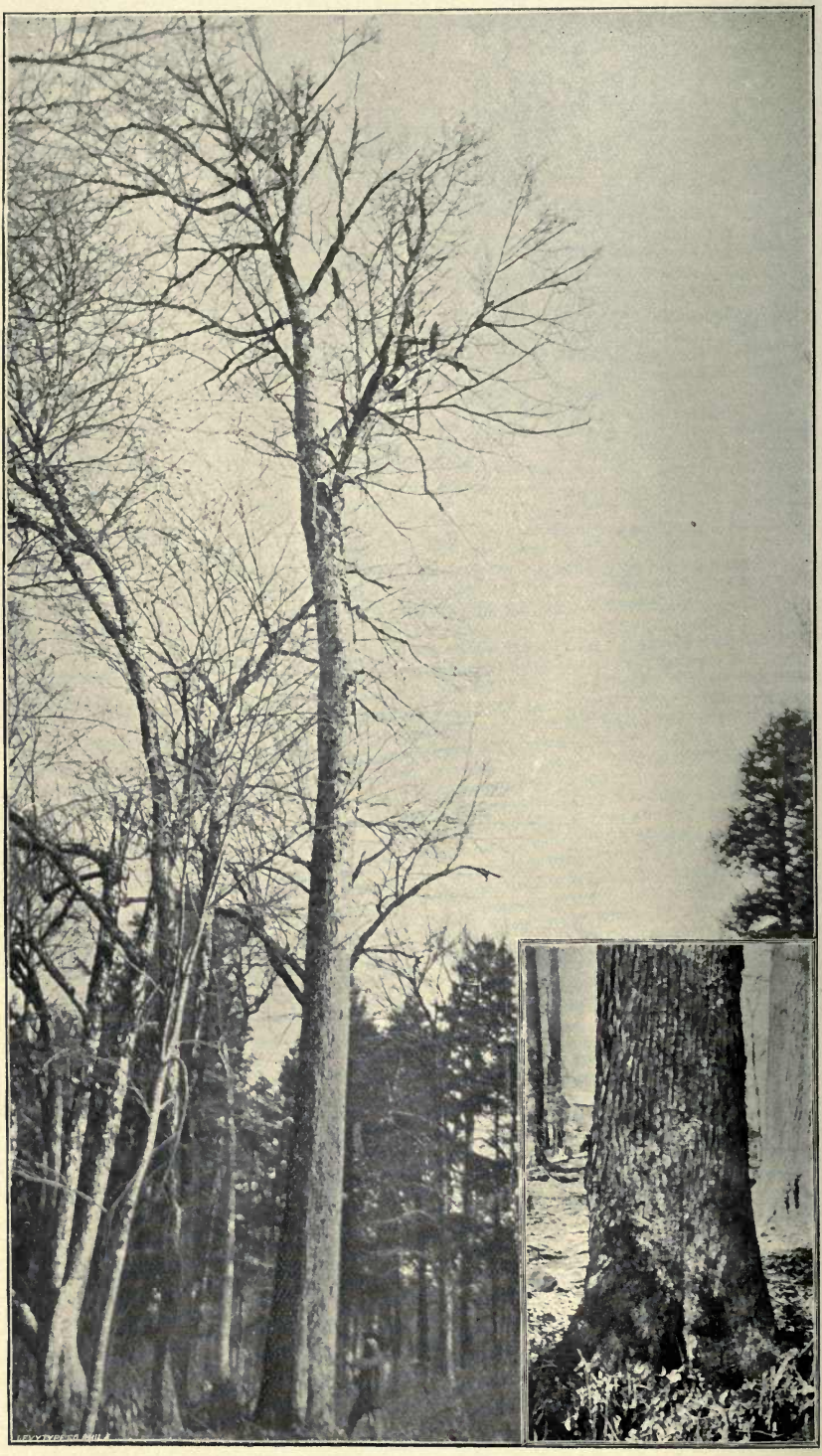
(SOUTHERN LIN. LINDEN.)

A slender tree, with a large oval crown, slender gray branches, and rough dark bark, reaching a height of 60 and a diameter of 2 feet.

It has been found as far north as Long Island, and it grows in cool, moist situations on the coast of North and South Carolina and Georgia, in northern Florida, Louisiana, and Texas. It is not a common tree.

In North Carolina, where it reaches a height of 50 to 60 feet, it occurs on deep, sandy, fertile soil, usually on the margins of swamps or streams, in the coastal plain region. (Fig. 5, p. 43.) In the Piedmont plateau region it occurs rarely, if at all.

A large proportion of the seed, which is borne frequently and in abundance, is unproductive, and seedlings are uncommon. It sprouts very freely from the stump.



LIN OR BASSWOOD

The leaves are covered beneath with a thin, rusty down. The flowers are smaller than in the preceding species, and the dry globose fruit is small, pubescent, and usually one-seeded. The winter-buds, which are covered with a short, fine pubescence, are of a dark reddish-brown color. The Southern lin has numerous usually deeply seated lateral roots.

The wood is similar to that of Tilia americana, of which this tree has been considered a variety.

Tilia heterophylla, Ventenat.

(LIN. LINDEN.)

A tree, with slender branches forming a pyramidal head, and furrowed bark broken into short thin light brown scales, occasionally reaching a height of 60 and a diameter of 4 feet. (Plate III.)

Growing in moist soil, often over limestone rock, it occurs from Pennsylvania southward along the Appalachians to northern Alabama and central Florida, and westward to middle Tennessee, Kentucky, and southern Indiana and Illinois; and reaches its best development on the mountain slopes of eastern Tennessee. It is not common.

In this State, where it reaches an average height of 40 feet and an average diameter of 12 to 18 inches, it is most common in the mountains, (fig. 5, p. 43), and occurs sparingly in the Piedmont plateau and coastal plain. It is much more abundant in North Carolina than Tilia americana, and bears seed more frequently and generally in greater quantity. It is readily propagated by shoots. Unless protected the low growth is almost immediately eaten by cattle.

The linden borer, Saperda vestita, Say, bores into the sapwood of the standing tree.

The leaves are generally larger than those of Tilia americana, and are covered on the lower side with a silvery white down. The flowers appear earlier in the spring, and the round fruit, $\frac{3}{8}$ inch in diameter, is covered with short gray down. The egg-shaped winter-buds are bright red, covered with a whitish bloom.

The wood is soft, light, straight-grained, not durable; light brown in color; the thin sapwood hardly distinguishable. Commercially it is not distinguished from the wood of Tilia americana.

Ilex opaca, Aiton.

(HOLLY.)

A small tree, with short, slender branches, which form a pyramidal head, and roughened light gray bark, reaching a height of 50 and a diameter of 4 feet.

At the north it grows in dry gravelly soil; at the south, in rich, moist situations. It occurs from Massachusetts to Florida; in the valley of the Mississippi from southern Indiana to the gulf of Mexico; and through Missouri, Arkansas and Louisiana to eastern Texas. It is common south of the Hudson in fertile bottom lands, except in the Appalachian region and just west of it, where it is exceedingly rare; and reaches its best development in southern Arkansas and eastern Texas.

In this State, where it grows to an average height of 30 feet, and an average diameter of 12 inches, it is common except in the mountains. Specimens growing in the coast region are much larger than those found further inland.

Fertile trees generally bear seed every year, although not with uniform abundance, and young growth is common in open spots. Old trees do not sprout from the stump as readily as young ones.

The oval evergreen leaves are thick, leathery and armed with spiny teeth. The flowers are small but conspicuous from their number. The round fruit is about ¼ inch in diameter, dull red or rarely yellow in color, and remains on the tree during the winter. The winter-buds are short, blunt or pointed, the narrow-pointed scales slightly hairy on the margins. The holly has a tap-root and numerous lateral roots.

The wood is light, tough, not strong, very close-grained; nearly white in color; the thick sapwood somewhat lighter. It is easily worked, takes a beautiful polish and is much used for cabinet-making, interior finish, and turning.

The merchantable holly has been largely cut in the northeastern counties; trees large enough for commercial use still remain, however, scattered through counties on the coast.

Cyrilla racemiflora, Linnæus.

(IRONWOOD. LEATHER WOOD. BOXWOOD.)

A slender tree, with numerous wide-spreading branches, and bright red-brown scaly bark, reaching a height of 35 feet and a diameter of 14 inches; or often a broad bush.

It occurs in various situations from North Carolina southward near the coast to middle Florida, and westward to eastern Texas, reaching its best development on the coast of the gulf of Mexico.

In this State it is found usually along streams and swamps from Hertford county southward, its western limits passing through Halifax, Wake, and Anson counties.

It usually produces seed very abundantly every second year, and young trees and seedlings are common on the borders of swamps and pine barren ponds. Trees are frequently hollow through the entire stem, even when quite young, generally as the result of a broken branch.

The small thick oblong leaves are partly evergreen in the extreme eastern part of the State. The numerous whitish flowers appear in slender racemes in the early part of summer, and the very small fruit is broadly egg-shaped. The narrow-pointed winter-buds are covered with chestnut-brown scales. The roots are lateral and superficial.

The wood is heavy, hard, weak, close-grained; light brown in color; the sapwood a little lighter; and is not used in North Carolina.

Aesculus octandra, Marshall.

(BUCKEYE. SWEET BUCKEYE.)

A large straight tree, with small, rather pendulous branches

and dark brown scaly bark, reaching a height of 90 and a diameter of 4 feet, or towards its southern or southwestern limit reduced to a low shrub.

It grows in deep fertile soil from Pennsylvania southward along the Alleghanies to northern Georgia and Alabama, and westward to southern Iowa and Indian Territory and western Texas, reaching its greatest development in the Alleghany mountains of Tennessee and North Carolina.

In this State it occurs as a tree in the mountains, and in the Piedmont plateau, where it is reduced to a mere shrub.

Trees growing in the open produce seed nearly every year; forest trees less frequently. Seedlings are common except in deep shade, especially in the Piedmont plateau. Young trees grow rapidly if sufficiently exposed to the light.

The buckeye stem-borers, Steganoptycha claypoleana, Fernald, and Proteoteras æsculana, Riley, penetrate the leaf-stems and twigs. Trees over 2 feet in diameter, particularly in very damp situations, are apt to be hollow or affected with dry rot.

The leaves are composed of 5 to 7 elliptical, pointed, sharply toothed leaflets. The yellowish flowers appear late in spring in large erect clusters, and the fruit is 2 or 3 inches long, with the reddish-brown seeds 1½ to 2 inches broad. The winter-buds are large and scaly.

The wood is light, soft, compact, and difficult to split; creamy-white in color; the sapwood hardly distinguishable. Although one of the commonest trees in the high mountains, it has but few uses; the softness of the wood and the fact that it decays rapidly when exposed to the weather or in contact with the soil, excludes it from construction. It is sometimes used with linden for ceiling and other interior work.

Acer spicatum, Lamarck.

(MOUNTAIN MAPLE. SWAMP DOGWOOD.)

A small bushy tree, with slender upright branches and reddish-brown bark, reaching a height of 30 feet and a diameter of 8 inches.

It occurs in the shade of other trees, from the valley of the St. Lawrence westward to northern Minnesota and the Saskatchewan region, and southward to northern Georgia; reaching its best development in the mountains of North Carolina and Tennessee.

In this State, where it is usually a shrub 6 to 10 feet high, it is confined to cold, damp places in the high mountains. It bears seed about every third year; seedlings are not common; but young sprouts are very abundant around old trees, which latter are usually hollow.

The leaves are 3 or rarely 5-lobed, coarsely toothed and downy beneath. The greenish-yellow flowers are in erect, slender clusters. The fruit is bright red in July, turning brown late in the autumn, and is rather more than an inch across. The winter-buds are sharply pointed. The root system is superficial.

The wood is light, soft, close-grained, compact; light brown in color; the sapwood being much lighter. The mountain maple does not grow large enough for commercial use.

Acer pennsylvanicum, Linnæus.

(STRIPED MAPLE. SWAMP DOGWOOD. DEERWOOD.)

A small tree, with slender, upright branches, and roughened reddish-brown bark. It reaches a height of 40 feet and a diameter of 10 inches, but is often much smaller, and shabby in habit.

It occurs from the valley of the Saguenay river westward to northeastern Minnesota, and southward to northern Georgia. It is common in the northern Atlantic states, but reaches its best development in the mountains of Tennessee and the Carolinas.

In this State it is confined to the coldest and dampest parts of the high mountains. Seed is produced annually or once in two years. Small trees are very sensitive to fire, but when burned sprout readily from the stump.

The leaves are large, 3-lobed at the end, and sharply toothed. They are much eaten by cattle. The greenish flowers occur in loose, drooping racemes, and the winged fruit is smooth, $\frac{3}{4}$ inch in length. The bright red winter-buds are stalked.

The wood is light, soft, and close-grained; light brown in color;

the thick sapwood of 30 to 40 layers of annual growth, still lighter. It is not used in North Carolina.

Acer barbatum, Michaux.*

(SUGAR MAPLE. SUGAR TREE. ROCK MAPLE.)

A large tree of great commercial value, with a broad round top when old, and light gray-brown deeply furrowed bark, reaching a height of 120 and a diameter of 4 feet. (Plate IV.)

It grows in rich woods, often forming extensive forests, and is most abundant in the mountains. It occurs from southern Newfoundland to the Lake of the Woods, southward to northern Alabama and western Florida, and westward to Minnesota, eastern Nebraska, Kansas and Texas; reaching its best development in the region of the great lakes.

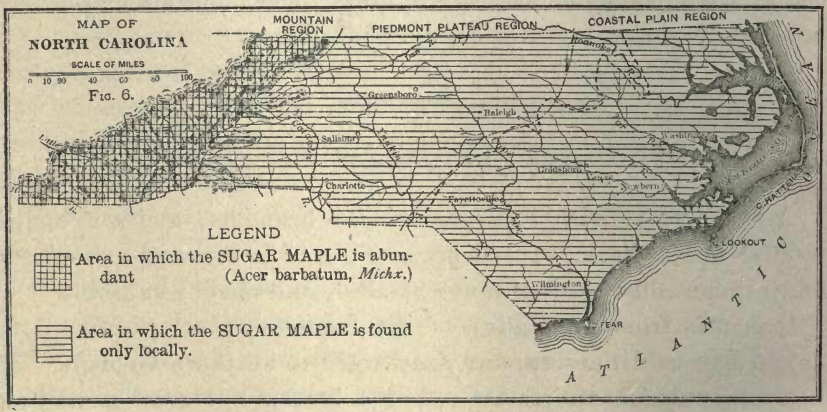
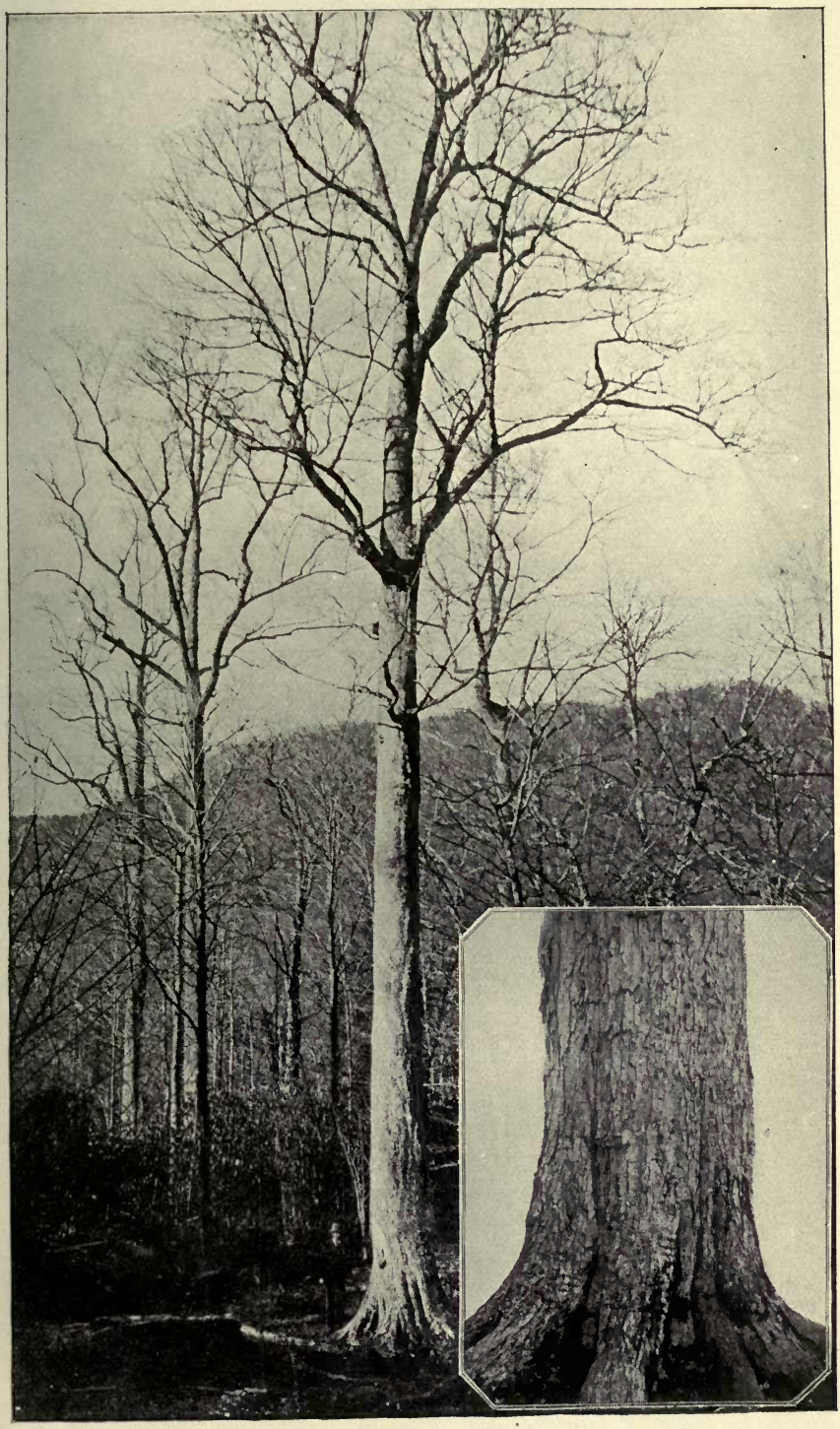


FIG. 6.

It occurs throughout this State, growing to an average height of from 50 to 80 feet and a diameter of 2 to 3 feet, but is most common in the mountains. It is a small tree in the Piedmont plateau and reduced to a mere shrub in the coastal plain region, where it is confined to borders of streams and swamps. (Fig. 6.)

The sugar maple bears seed about every third or fourth year. Seedlings are very abundant in the woods, and bear dense shade remarkably well; they spring up quickly in thinned woods, also, and where lumbering has been in progress.

*Acer saccharinum, Wagn.



SUGAR MAPLE

Glycobius speciosus, Say, a borer destroys the trees by girdling them or penetrating the wood, and young specimens are killed by a timber beetle, Corthylus punctatissimus, Zimm., which enters and mines the stem at or near the surface of the ground.

The leaves are 3 to 5-lobed, with rounded notches, heart-shaped at the base, smooth above, and glaucous beneath The greenish-yellow flowers occur in umbel-like clusters, appearing with the leaves in the spring. The winged fruit is an inch in length. The purple winter-buds are pointed, ¼ inch in length. The sugar maple has a tap-root and numerous strong lateral roots.

The wood is heavy, hard, strong, close-grained, tough, and takes a good polish. The heartwood is light brown; the thin sapwood, of 30 or 40 layers of annual growth, somewhat lighter. It is more valuable than the wood of any other American maple, and is largely used as fuel, for interior finish, furniture, and turnery, in ship-building, for the handles of tools, saddle-trees, shoe-lasts, shoe-pegs. Curled and bird's-eye maple are highly prized for cabinet work. Maple sugar is produced chiefly from this tree, and its ashes make a valuable fertilizer.

Acer saccharinum, Linnæus.*

(SILVER MAPLE. MAPLE. SOFT MAPLE.)

A large tree, with upright main branches and pendulous branchlets, and reddish-brown scaly bark, reaching a height of 120 and a diameter of 4 feet.

It grows in rich soil, and is most common west of the Alleghany mountains. It occurs from New Brunswick to Ontario, southward to western Florida, westward to eastern Dakota, eastern Nebraska, the valley of the Blue river, Kansas and the Indian Territory, reaching its best development in the basin of the lower Ohio river.

In this State, where it is not very common, it occurs in the upper part of the Piedmont plateau and in the mountains along streams and in cool situations, and attains a height of 30 to 50 and a diameter of 1 to 2 feet.

*Acer dasycarpum, Ehrh.

Young growth is frequent on moist land, where the forest cover is light, and in old fields. It produces seed at irregular intervals, and for the most part, not abundantly. Trees under a foot in diameter sprout freely from the stump. Very large specimens are apt to be hollow.

The deeply cut 5-lobed leaves are pale green above and silvery white beneath. The crowded clusters of greenish-yellow flowers appear before the leaves in early spring, and the pale chestnut-brown winged fruit is prominently netted-veined, and from 1½ to 3 inches in length. The short thick winter-buds are covered with bright red scales. The silver maple has a small tap-root and numerous strong lateral roots.

The wood is hard, strong, close-grained, compact, easily worked, and rather brittle; faintly tinged with brown, with thick sapwood composed of 40 to 50 layers of annual growth. It is sometimes used for cheap furniture and flooring. Maple sugar is occasionally made from this tree.

Acer rubrum, Linnæus.

(RED MAPLE. SWAMP MAPLE. MAPLE.)

A slender tree, with upright branches and dark gray flaky bark, reaching a height of 120 and a diameter of 4½ feet.

It grows in low, moist situations, from Quebec and the Lake of the Woods southward to the Indian river, Florida, and west to the eastern parts of Dakota, Nebraska, Indian Territory, and Texas; and reaches its best development on the lower Ohio and its tributaries.

In this State it occurs in swamps and low grounds, from the coast to the mountains, but is most abundant in the coastal plain.

There is a large production of seed about every second year; young trees are always common in damp woods and along streams. Old trees sprout from the stump less rapidly than younger ones.

The leaves are smaller and not so deeply cleft as those of the silver maple. The flowers, which appear early in spring, are bright scarlet or, less commonly, dull yellowish-red. The winged fruit is scarlet, dark red or brown, ½ to 1 inch in length; it ripens

early in summer and sprouts immediately on falling to the ground. The short winter-buds are blunt and covered with thick dark red scales. The red maple has numerous strong lateral roots.

The wood is very heavy, close-grained, easily worked, and not very strong. It is light brown in color; the thick sapwood, somewhat lighter. But little has been cut in North Carolina. It is employed mainly for interior finish, furniture, gunstocks and similar uses. Maple sugar is occasionally made from this species, the sap being mixed with that of the sugar maple; and there does not appear to be any marked difference between the sap from the two species, except that that from the red maple contains a smaller per cent. of sugar.

Acer negundo, Linnæus.*

(BOXELDER. ASHLEAF MAPLE.)

A tree, with a short trunk, and light gray or brown, deeply furrowed bark, reaching a height of 70 and a diameter of 4 feet.

It ranges from Vermont to Florida; extending northwest and west to Lake Winnipeg, and the eastern slopes of the Rocky mountains; and southward to Texas, New Mexico and Arizona. It grows on the banks of streams and lakes and the borders of swamps, reaching its best development in the valleys of the tributaries of the lower Ohio river. In good soil it grows rapidly.

In North Carolina it is rare in the coastal plain region, but common in the Piedmont plateau and west to the mountains, attaining an average height of 15 to 25 feet.

The leaves are composed of from 3 to 5 or rarely, sparingly toothed leaflets. The yellowish-green flowers occur in drooping clusters, usually appearing before the leaves; the sterile and fertile flowers on separate trees. The winged fruit is 1½ to nearly 2 inches long, with the thin netted-veined wings diverging at a very sharp angle. The winter-buds are covered with pale down; the lateral buds blunt, the terminal bud acute. The light, soft, weak, close-grained wood is creamy-white, with a thick and hardly distinguishable sapwood. It is sometimes used for interior finish,

* Negundo aceroides, Moench.

cheap furniture, woodenware, cooperage and paper pulp. Maple sugar is occasionally made from this species.

Robinia pseudacacia, Linnæus.

(LOCUST. BLACK LOCUST. YELLOW LOCUST.)

A slender tree, with erect brittle branches forming an oblong head, and deeply furrowed dark brown bark. It reaches a height of 80 and a diameter of 4 feet.

It occurs from Pennsylvania to Georgia along the Appalachian mountains, growing with hickory, black walnut, ash, white oak, and the chestnut; and reaches its best development on the western slopes of the mountains in West Virginia. It has been naturalized in most of the states east of the Rocky mountains.

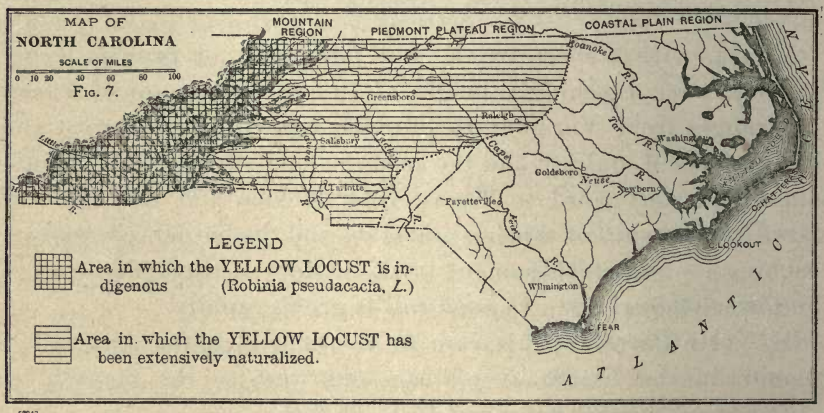


Fig. 7.

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In this State it occurs on the lower ridges of the mountains, and probably for some distance east of the Blue Ridge. (Fig. 7.)

Forest trees bear seed only once in three or four years. In the open the production of seed is more frequent and seedlings, which are short-lived in the shade, more common. The locust is readily propagated by root suckers, and trees as large as one foot in diameter sprout from the stump. The growth is rapid in youth; in mature trees much slower. When cut in the forest, it is usually succeeded by oaks and chestnut. Old trees are apt to be hollow at the butt, and frequently in the upper part of the stem, from the entrance of water where the brittle limbs have been broken off.

A borer, Cyllene robiniæ, Forster, destroys the value of large trees or kills them entirely, and bark beetles often kill the young plants. The timber is also attacked by the larvæ of Xylesthia clemensella, Chamb.

The leaves consist of from 7 to 19 thin ovate leaflets. The white flowers appear in April in large drooping clusters, and the bright red-brown fruit is a stout pod 3 to 4 inches long. The minute naked winter-buds are inconspicuous. The locust has numerous superficial lateral roots.

The wood is heavy, hard, close-grained, and very durable in contact with the soil; brown or light green in color; the very thin sapwood, of 2 to 3 layers of annual growth, pale yellow. It is extensively used in ship building and for treenails, construction, posts, and other purposes where durability in contact with the ground is desired. It is excellent fuel, and is altogether one of the most valuable timbers of the American forest. The bark of the root is tonic, purgative, and emetic.

Large quantities of locust have been cut in Jackson, Macon, Swain, and Rutherford counties.

Robinia viscosa, Ventenat.

(CLAMMY LOCUST.)

A small tree, with slender spreading branches and smooth dark brown bark, reaching a height of 40 feet and a diameter of 12 inches.

It occurs in the high mountains of the Carolinas, and has become extensively naturalized east of the Mississippi. In this State it is found on Buzzard ridge in Macon county, growing as a shrub only a few feet high. It has not been seen growing wild in any other locality since the time of Michaux.

The twigs and leaf-stalks are covered with a sticky substance. The rose-colored flowers are in short rather compact clusters and the fruit is a pod 2 to 3½ inches in length. The minute winter-buds are covered up in the scars of the leaves of the previous season.

The wood is heavy, hard, close-grained, and brown in color; the thin sapwood light yellow.

Cladrastis lutea, Koch.

(YELLOW WOOD. VIRGILIA. CHITTAM.)

A tree, with branching trunk, wide-spread pendulous branches, and smooth silvery gray or light brown bark, reaching a height of 60 and a diameter of 4 feet.

It occurs in central Kentucky, central Tennessee, on the mountains of eastern Tennessee and in North Carolina, and is one of the rarest and most local trees of eastern North America. It grows generally in rich soil, and reaches its best development near Nashville, Tenn.

In this State, where it is found in Swain, Clay, Macon, and Cherokee counties, it has an average diameter of 18 inches and a height of about 40 feet.

Large numbers of pods are borne about every second year, but they contain many abortive seeds. Seedlings are common near old trees, when cattle are excluded. Numerous sprouts come up around old trees and about live stumps.

In Clay county a large part of the foliage of yellow wood is often destroyed in the early fall by the leaf miner insect.

The leaves are composed of 7 to 11 broadly oval entire leaflets placed alternately along the leaf stalks. The white flowers are borne in long terminal drooping racemes. The fruit is a pod 1½ to 4 inches in length. The lustrous brown downy winter-buds are in fours, superposed, and crowded together to form a cone. The superficial lateral roots are long and very tough.

The wood is heavy, very hard, strong and close-grained; bright clear yellow in color; the thin sapwood almost white. It takes a good polish, is used for fuel and gunstocks, and yields a clear yellow dye.

Gleditschia triacanthos, Linnæus.

(HONEY LOCUST.)

A large tree, with slender spreading branches and dark rough deeply fissured bark, reaching a height of 140 and a diameter of 6 feet.

It occurs from Pennsylvania westward to eastern Nebraska, Kansas, and Indian Territory, southward to northern Alabama, Mississippi, and Texas, reaching its best development in southern Indiana and Illinois. It has been naturalized east of the Alleghany mountains, growing in moist fertile soil, or less commonly on dry gravelly hills.

The honey locust is scarcely known as a forest tree in North Corolina. Specimens of it, however, are found commonly on farms and along fences in the Piedmont plateau, and sparingly in the other sections.

It bears some seed every year and a large amount every third year. Seedlings, which are frequently found on dry ground under old trees, grow very rapidly. Sprouts are common about young specimens and appear quickly around the stumps of felled trees.

The leaves consist of numerous small, oblong, remotely toothed leaflets, and are sometimes doubly pinnate. The inconspicuous greenish flowers are in small spikes, and the fruit is a dark brown pod, often 10 to 18 inches in length. The minute winter-buds occur three or four together. Very sharp and rigid three-forked or simple spines, 3 to 4 inches long, and bright chestnut-brown in color, are very plentiful on some individuals and nearly or quite wanting in others. The honey locust has long superficial roots.

The wood is hard, strong, coarse-grained, and very durable in contact with the ground; red or bright red brown in color; the sapwood, of 10 to 12 layers of annual growth, thin and pale. It is largely used for fencing, for the hubs of wheels, and somewhat in construction.

Cercis canadensis, Linnæus.

(REDBUD. JUDAS TREE.)

A small tree, with a short trunk, bright red-brown furrowed bark, and smooth light brown or gray branches, reaching a height of 50 feet and a diameter of 12 inches.

It is found from New Jersey to Florida, Alabama and Mississippi, Indian Territory, Louisiana and Texas, growing on the bor-

ders of swamps and in rich bottom lands; and it reaches its best development in southern Arkansas, Indian Territory, and eastern Texas.

In North Carolina, where it attains a height of 15 to 25 feet, it occurs in the coastal plain and Piedmont plateau regions.

The dark green glossy leaves are broadly ovate, pointed at the apex, and truncate or heart-shaped at the base. The conspicuous bright purplish-red flowers are in clusters along the branches, and appear before or with the leaves in early spring The fruit is an oblong compressed many-seeded pod, from 2½ to 3½ inches long. The winter-buds are blunt and chestnut-brown in color.

The wood is rather coarse-grained, heavy, hard, and not very strong. Its color is a rich dark brown, tinged with red; the thin sapwood lighter.

Prunus pennsylvanica, Linnæus.

(WILD RED CHERRY. FIRE CHERRY. BIRD CHERRY. PERUVIAN.)

A small tree, with slender branches, a narrow head and smooth reddish-brown, or in old trees, dark red-brown scaly bark. It reaches a height of 30 to 40 feet and a diameter of 12 to 18 inches; but at its northern and western limits it is a low shrub.

It occurs from Newfoundland to British Columbia, south through the northern states to Pennsylvania, Michigan, Illinois, and Iowa, on the eastern slopes of the Rocky mountains in Colorado, and along the Alleghany mountains of North Carolina and Tennessee; and reaches its best development on moist, rather rich soil, in the Big Smoky mountains of Tennessee. It often takes possession of ground which has been cleared by fire.

In North Carolina it is confined to damp situations on the slopes of high mountains, above an elevation of 3,500 feet. (Fig 8, p. 59)

It bears seed in great abundance, and usually every year. After spruce or Carolina balsam, or sometimes beech and maple forests, have been burned, a growth of fire cherry often springs up, but it is apt to be replaced by the original growth in about forty years, which is the average length of life for this tree.

The oblong, sharply pointed leaves are finely toothed, shining

A GROUP OF WILD CHERRY TREES

green and smooth on both sides. The white flowers appear late in the spring in numerous clusters, and the fruit is small, round and bright red.

The light, soft, close-grained compact wood is light brown in color; the sapwood a clear yellow.

Prunus serotina, Ehrhardt.

(WILD BLACK CHERRY.)

A tree of the first commercial importance, with small horizontal branches and dark red-brown scaly bark, reaching a height of 100 feet and a diameter of 5 feet. (Plate V.)

It occurs from Nova Scotia to Tampa Bay in Florida, and westward to the Missouri river in Dakota, eastern Nebraska and Kansas, Indian Territory and Texas, and is found also in southern New Mexico and Arizona, and in parts of Mexico, Central and South America. It reaches its best devolopment on the high slopes of the Alleghany mountains. It was once common in all the Appalachian region, growing with the white oak, the white ash, the green ash, the sugar maple, the yellow buckeye, the hickories and the black birch.

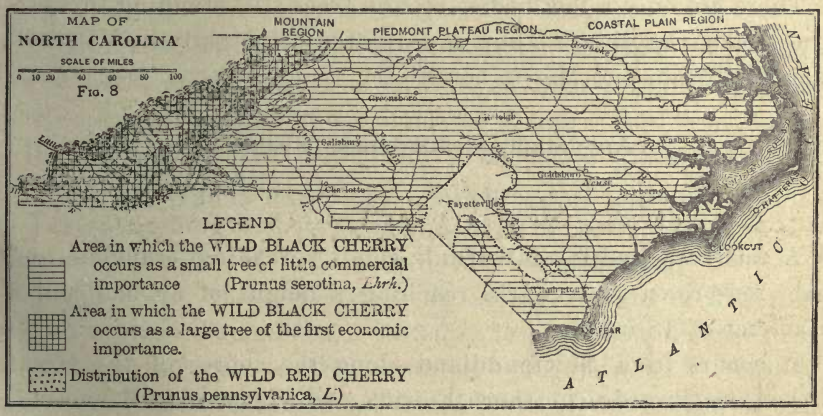


FIG. 8

In this State, where it attains an average height of 60 to 80 and a diameter of 2 to 3 feet, it occurs through all parts of the State, but is less common in the coastal plain, where the soil and climate are not so favorable to its growth. It reaches its best dimensions on the rich cool slopes of the mountains. (Fig. 8.)

Forest trees bear fruit abundantly about every third or fourth year; trees growing in the open more frequently. Seedlings are common in moist, rather open situations. In the higher mountains, where only it grows large enough to be of economic importance, trees over three feet in diameter are apt to be hollow or red-hearted. Old trees are often shaky. After lumbering, the black cherry is frequently followed by birch, ash, spruce, and maple.

Clisiocampa americana, Stretch, the tent caterpillar, destroys the young trees by denuding them of their foliage.

The leaves are oblong, smooth, taper-pointed, and finely-serrate with short incurved teeth. The flowers appear in late spring in long, slender, drooping racemes; and the fruit is bitter, nearly black when ripe, and from $\frac{1}{3}$ to $\frac{1}{2}$ inch in diameter. The blunt or pointed winter-buds are bright chestnut-brown.

The wood is light, strong, rather hard, with a close straight grain; light brown or red in color; the thin sapwood, of 10 or 12 layers of annual growth, yellow. It takes a beautiful polish, and no other North American wood is more suitable for cabinet-making and fine interior finish. The largest and best trees in all parts of the country have already been cut. The bark yields tonics and sedatives.

There are only a few bodies of fine trees still standing in western North Carolina. They are situated principally in Mitchell, Yancey, Swain and Macon counties.

Amelanchier canadensis, Medicus.

(SERVICE TREE. SHAD BUSH. WILD CURRANT.)

A small tree, with a tall trunk, small spreading branches, and pale red-brown scaly bark, reaching a height of 50 feet and a diameter of 18 inches.

It occurs from Newfoundland along the shores of the Great Lakes, southward to northern Florida, and westward to Minnesota, eastern Nebraska, eastern Kansas, Louisiana, and southern Arkansas; reaching its best development in the mountains of North Carolina and Tennessee.

In the coastal plain region of North Carolina it is hardly more than a shrub, and is known as wild currant. It reaches its largest

size on the shaded slopes of the mountains, where it is called service tree.

About every third year this tree bears fruit in large quantities; during intermediate years, sparingly or not at all. Seedlings are common in moist and shady woods.

The leaves are small, finely toothed, acute at the apex and rounded or heart-shaped at the base. The white flowers appear in drooping racemes in early spring. The sweet edible rounded fruit is dark purple when ripe, and from $\frac{1}{3}$ to $\frac{1}{2}$ inch in diameter. The pale chestnut-brown pointed winter-buds, $\frac{1}{4}$ inch long, are covered with slightly hairy scales. The service tree has numerous superficial lateral roots.

The wood is heavy, exceedingly hard, strong and close-grained; dark brown in color; the thick sapwood, of 40 to 50 layers of annual growth, lighter. It takes a good polish, and is occasionally used for the handles of tools.

In North Carolina the wood has few uses; large numbers of trees, however, are cut every year for the fruit.

Liquidambar styraciflua, Linnæus.

(SWEET GUM. RED GUM.)

A large tree, with straight cylindrical trunk, dark deeply furrowed bark, and branches often winged with corky ridges. It reaches a height of 140 and a diameter of 5 to 6 feet.

It occurs from Connecticut to Missouri, south to Central Florida and westward, through Arkansas and Indian Territory, to Texas, reaching its best development in the bottom lands of the Mississippi basin. It is common in low wet situations.

In this State, where it attains an average height of about 60 and an average diameter of 2 to 3 feet, it is common in moist situations from the coast to the mountains. (Fig. 9, p. 62.) West of the Blue Ridge it is sometimes found south of the French Broad river. It is in the coastal plain that it attains its largest dimensions, growing frequently in deep swamps with the black gum and cypress, to a diameter of 5 or 6 feet and height of one hundred feet.

Sweet gum bears fruit annually or every other year, but much of the seed is abortive. Young seedlings are common on damp hillsides and bottom lands that have been cleared, they are also

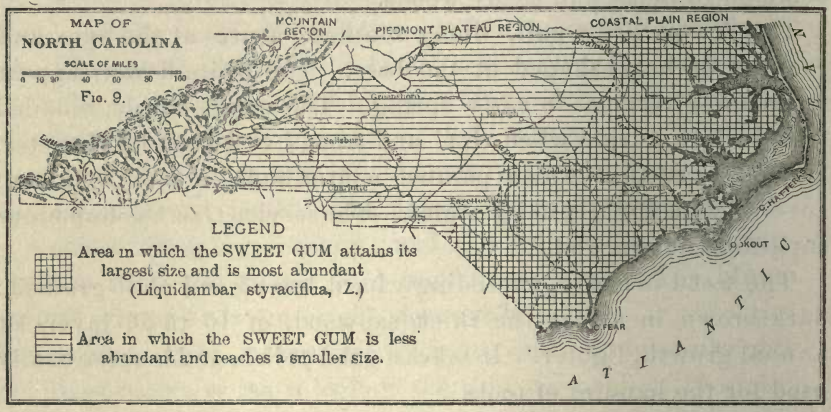


FIG. 9.

frequent in damp pine woods, where, however, they seldom develop into large trees. After sweet gum has been cut a thick growth of the same species usually springs up together with yellow poplar, white oak and maple. The largest specimens are frequently hollow at the butt. This tree sprouts freely from the stump.

The smooth shining leaves are deeply 5 to 7-cleft with sharp pointed finely toothed divisions. The inconspicuous flowers occur in early spring. The fruit is a long-stalked, globular, dry, rough head, hanging on the tree through the winter. The acute ovate winter-buds are dark brown in color.

The sweet gum has a very large and long tap-root, as well as long superficial roots.

The wood is heavy, hard, not strong, rather tough, close-grained, and liable to warp and shrink; bright brown in color; the sapwood nearly white. It takes a good polish and is used for flooring, clapboards, cabinet work, veneering, barrels, and street paving. The balsamic exudation is sometimes employed in cases of catarrh and as an ointment.

Only an inconsiderable quantity has been sawed in the State,

but it is now being largely used for the manufacture of crates baskets, veneering, barrels, etc.

Cornus florida, Linnæus.

(DOGWOOD. FLOWERING DOGWOOD. BOXWOOD.)

A small tree, with flattened spreading top and rough blackish bark, reaching a height of 40 feet and a diameter of 18 inches.

It is common in rich woods from southern New England west to southern Ontario, and south to Florida and eastern Texas.

In this State, where it reaches an average height of 12 to 20 feet, it occurs throughout. In the coastal plain it forms a lower story under the long-leaf pine. In the Piedmont plateau and mountain region it grows under oaks, hickories and yellow poplar.

Dogwood generally bears fruit abundantly every year, and young seedlings are common in open woods, and in mixed coppice woods on moist soil. When once started it bears a deep shade. The acute ovate leaves are opposite and often somewhat clustered toward the ends of the branchlets. The flowers occur in a head surrounded by 4 white bracts, which make the cluster appear like a single large flower, and the bright red oval fruit grows in bunches. The awl-shaped leaf-buds, as well as the twigs, are purplish and covered with a whitish bloom. The rounded flattened grayish-brown flower-buds replace the terminal buds on the fertile branches. The dogwood has numerous long lateral roots.

The wood is hard, heavy, strong, close-grained, and tough; brown in color; the sapwood lighter. It takes a beautiful polish, and is extensively used for turnery, wood engraving, the bearings of machinery, the hubs of wheels, barrel hoops, shuttles, spindles, etc. The bark yields a tonic.

Large quantities have been cut in the eastern and central sections of the State, along the railroads, and manufactured into spindle, shuttle, and shoe-last blocks, but the supply has by no means been exhausted.

Nyssa sylvatica, Marshall.

(BLACK GUM. SOUR GUM.)

A large tree, with horizontal branches and short spur-like lateral

branchlets, reaching a height of 100 and a diameter of 5 feet. The bark is deeply cut, light brown, often tinged with red, or, as in some large specimens in the coastal plain region of this State, scaly or nearly smooth, dark brown or black.

It occurs from Maine and Vermont to central Michigan, and southward to Tampa bay, Florida, and the Brazos river, Texas.

In North Carolina, where it has an average height of 50 to 60 feet and an average diameter of about 2 feet, it occurs in the swamps and wet lands of the coastal plain and Piedmont plateau,

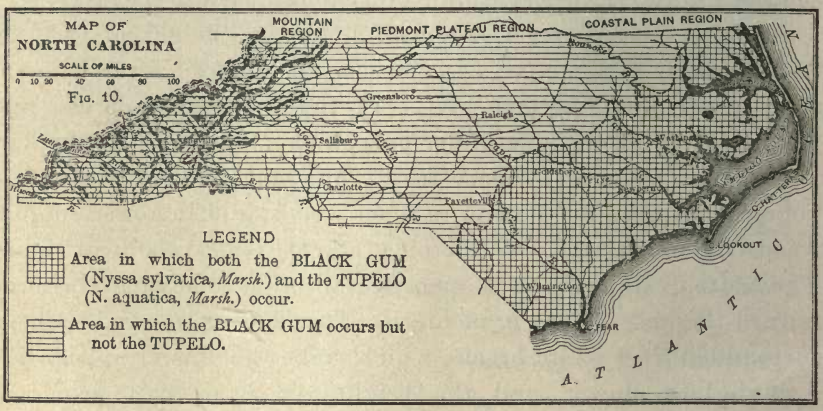


Fig. 10.

and in the mountains up to an elevation of 3,000 feet, along dry ridges with red and white oaks and chestnut. In the eastern sections, with the sweet gum and water ash, it forms a large part of the growth of the deeper swamps, and there reaches its largest size within the State. (Fig. 10.)

It produces seed plentifully once in two or three years, and young seedlings appear in moist open woods and on cypress lands after lumbering. Large trees are apt to be hollow at the butt and frequently through the whole stem. The black gum sprouts readily from the stump.

The rather thick shining leaves are oblong, pointed and usually entire. The greenish flowers, which appear after the leaves in spring, are inconspicuous, and the bluish-black oval fruit is about ½-inch long. The dark brown conical buds are slightly thicker than the smooth flexible twigs. The black gum has deeply seated lateral and numerous superficial roots.

The wood is heavy, strong, soft, very tough, and hard to split and work, inclined to check, and not durable in contact with the soil; light yellow or nearly white in color; the thick sapwood lighter, often hardly distinguishable. It is used for the hubs of wheels, rollers in glass factories, ox yokes, and piles.

Very little has been cut in this State for lumber. In the last few years, however, it has been coming into use as a cheap material for boxes and trucking barrels.

Nyssa aquatica, Marshall.

(TUPELO GUM.)

A large tree, with dark brown, deeply furrowed, or, in old specimens, scaly, smoothish bark, reaching a height of 100 and a diameter of 4 feet.

It occurs from southern Virginia to Georgia, through the Gulf states to Texas, and through Arkansas and southern Missouri to Illinois; reaching its best development in the cypress swamps of western Louisiana and southeastern Texas.

In this State it is confined to the deep swamps of the coastal plain, where it grows with cypress, water ash and black gum, attaining a height of 80 and a diameter of 4 feet above the trumpet-shaped base. (Fig. 10, p. 64.)

Seed years are frequent. Young trees are common along moist, deep swamps, in open woods, and in spots where the cypress has been removed. The large swollen butt, 8 to 15 feet in diameter, is usually hollow, and there is frequently also a hollow in the top of the stem, where a branch has been broken off. The middle of the trunk is nearly always sound.

The leaves are larger than in the preceding species, dark green and smooth above and somewhat downy below. The yellowish-green flowers appear in March and April. The oblong fruit is dark purple and an inch or more in length. The smooth light brown terminal buds are nearly round, the lateral buds minute. The twigs are slightly angular, light brown and smooth, and much thicker than those of the black gum. There are numerous lateral and superficial roots.

The wood is light, soft, not strong, close-grained, compact, unwedgeable, and light brown or nearly white in color. It is used for turning, woodenware, broomhandles, and wooden shoes. The roots are sometimes used as a substitute for cork for net floats. The wood has only a few local uses in North Carolina.

Oxydendron arboreum, De Candolle.

(SOURWOOD. SORREL TREE.)

A small tree, with pendulous branches and deeply furrowed gray-brown bark, reaching a height of 60 feet and a diameter of 20 inches.

It grows usually in rather dry soil, and occurs from western Pennsylvania along the Alleghany mountains to western Florida and Mobile bay, westward to middle Tennessee, and through the northern portions of the Gulf states to western Louisiana. It attains its best development in eastern Tennessee.

In North Carolina, where it reaches a height of 50 to 60 feet and a diameter of 12 to 15 inches, it is rare (and usually a shrub) in the coastal plain, not uncommon in the Piedmont plateau, and most abundant in the lower parts of the mountains. It reaches its largest size on the eastern slopes of the Blue Ridge.

The sourwood bears seed prolifically and for the most part every year. Young seedlings are usually very abundant, especially in rather dry woods which have been thinned. Sprouts grow readily from the stump, but do not attain a very large size. Trees over 10 inches in diameter are usually hollow.

The small rounded fruit is in large loose clusters. The oblong pointed leaves are acid, whence the name. The flowers and fruit occur in loose drooping panicles, 7 to 8 inches long. The red winter-buds are very small, and the flexible twigs are mahogany-red in color. The sourwood has numerous lateral roots. This tree is especially prized on account of the delicious transparent honey made from the flowers.

The wood is heavy, hard, very close-grained, compact, brown in color; the sapwood somewhat lighter. It takes a beautiful

polish, and is used for the handles of tools, bearings of machinery, etc.

Kalmia latifolia, Linnæus.

(LAUREL. IVY. WICKY.)

A small evergreen tree, with short crooked branches, and dark reddish-brown furrowed bark, the narrow ridges separating into long scales. It reaches a height of 40 feet and a diameter of 20 inches.

It occurs in rich woodlands from New Brunswick and Lake Erie to western Florida, and through the Gulf states to western Louisiana and the valley of the Red river, Arkansas; reaching its best development in the southern Alleghany mountains, where it often forms dense impenetrable thickets.

In this State, where it grows to an average height of 10 to 15 feet, it is most abundant in the mountains, but occurs in the Piedmont plateau, and extends into the coastal plain region.

The laurel bears seed every year, and for the most part in abundance. Young seedlings, in all stages of growth, are common in moist open places in the mountain region, and above 3,000 feet on rather dry soil. The fires which are frequent on these dry ridges are very destructive to both young and old plants, but the laurel sprouts so freely from the stump that it often takes exclusive possession of areas subject to repeated fires.

The evergreen leaves are thick, smooth, entire, acute at the apex and contracted at the base. The white or pink flowers are produced in conspicuous clusters at the ends of the branches, and the rounded fruit set with sticky hairs is ripe in September. The winter-buds are small, oblong, and greenish. The roots consist of many large knots and burls, from which strong lateral roots diverge.

The wood is heavy, hard, strong, brittle, close-grained, and compact, brown in color; the sapwood somewhat lighter, and the broad medullary rays darker. It takes a good polish, and is used for the handles of tools, in turnery, and for fuel. The leaves, from which an ointment is made, are supposed to be poisonous to cattle. The root-burls, sometimes called ivy grubs, are used in

turnery. Large quantities are taken out at Cranberry, Elk Park, and many other places in the mountain counties.

Rhododendron maximum, Linnæus.

(RHODODENDRON. LAUREL.)

A small tree, with spreading top and grayish-brown scaly bark, reaching a height of 40 feet and a diameter rarely exceeding twelve inches; or more frequently a tall straggling shrub.

It occurs from Nova Scotia and Lake Erie south through New England, New York, and along the Alleghanies to northern Georgia; reaching its best development on the steep rocky banks of streams in the southern Alleghany mountains. It is never found on limestone soils.

In North Carolina, where it grows to an average height of 8 to 12 feet, it is very common in the mountains, often forming impenetrable thickets, and occurs in ravines in the Piedmont counties as far east as Surry and Gaston.

Rhododendron usually produces seed every year, and young seedlings are common in moist open spots. Numerous sprouts appear around old trunks and around the stumps after cutting. Several stems generally grow from the same burly roots.

The thick leathery evergreen leaves are acute at the apex and narrowed toward the base. The flowers are pale rose-color or white, dotted with yellowish-green spots, and are produced in large compact clusters at the ends of the branchlets. The dark red-brown fruit is a dry capsule, half an inch long, and encloses many seeds. The buds are large, scaly and conical.

The wood is heavy, hard, strong, brittle, close-grained, compact, light clear brown in color; the sapwood lighter. It is occasionally employed in turnery, for tool handles, etc. A decoction of the leaves is used for rheumatism, sciatica, etc.

Diospyros virginiana, Linnæus.

(PERSIMMON.)

A small tree, with slender branches forming a rounded top and rough, dark brown, gray or black bark, reaching a height of 115 and a diameter of 2 feet.

It occurs commonly in old fields from southern Connecticut to southern Ohio and southeastern Iowa, south to Bay Biscayne, Florida, southern Alabama and Mississippi, and west to southern Missouri, Arkansas, eastern Kansas and Indian Territory, and the valley of the Colorado river, Texas; and reaches its best development in the lower Ohio basin.

In this State, where it reaches an average height of 30 to 40 feet and an average diameter of 18 to 20 inches, it is found throughout, except in Ashe, Watauga, Mitchell, and Yancey counties and in the higher mountains. (Fig. 11.)

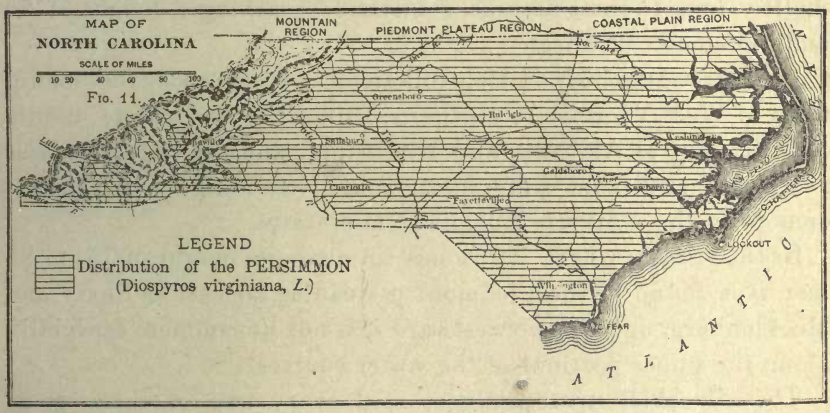


FIG. 11.

Fertile trees bear fruit in abundance annually or every second year. Seedlings are common near the old trees in damp soil, and in old fields when protected from fire. Young plants are short-lived in deep shade.

The rather thick smooth shining leaves are oval, dark green above, pale and often downy below. The yellowish flowers are small and inconspicuous, the male and female usually produced on separate trees. The edible fruit is rounded, about one inch in diameter, and orange-red when ripe. The winter-buds are small, egg-shaped and pointed. The persimmon has thick fleshy black stoloniferous roots; it has a taproot as well as numerous long lateral roots.

The wood is heavy, hard, strong, very close-grained, compact; the heartwood, seen only in very old specimens, dark brown to nearly black in color; the thick sapwood lighter brown with dark spots. It takes a good polish, and is used for shoe-lasts, plane

stocks, shuttles, large screws, mallets and the shafts of wagons. A decoction for diarrhœa, hemorrhage, etc., is made from the fruit, from which persimmon beer is also produced.

Large quantities have been cut in North Carolina near the railroads.

Mohrodendron carolinum, Britton.*

(SNOWDROP TREE. SILVERBELL TREE.)

A tree of medium or small size, with reddish-brown, broadly ridged bark, and bright brown smooth branches striped with pale shallow longitudinal fissures, sometimes reaching a height of 90 and a diameter of 3 feet.

It occurs commonly in rich soil along streams from the mountains of West Virginia to southern Illinois, southward to middle Florida, central Alabama and Mississippi, and through Arkansas to western Louisiana and eastern Texas; reaching its best development in the southern Alleghany mountains.

In this State, where it reaches an average height of 15 to 25 feet, it is found in the Piedmont plateau as far east as Surry and Mecklenburg, and thence westward it is not uncommon, especially along the upper portions of the water courses.

The silverbell tree produces seed every two or three years and young plants are common in damp shady woods. Specimens over one foot in diameter are apt to be hollow.

The thin leaves are finely serrate, light green above, pale, and slightly downy below. The flowers, which appear with the leaves in spring, are white, bell-shaped, and are borne by slender drooping stems. The large dry fruit, about 1½ inches long, has four wings and contains a bony nut. The hairy winter-buds are small, obtuse, and dark red or light brown.

The wood is light, soft, close-grained, compact, light brown in color; the sapwood lighter. It has no uses in North Carolina.

Fraxinus americana, Linnæus.

(WHITE ASH.)

A large tree of the first commercial value, with stout, upright

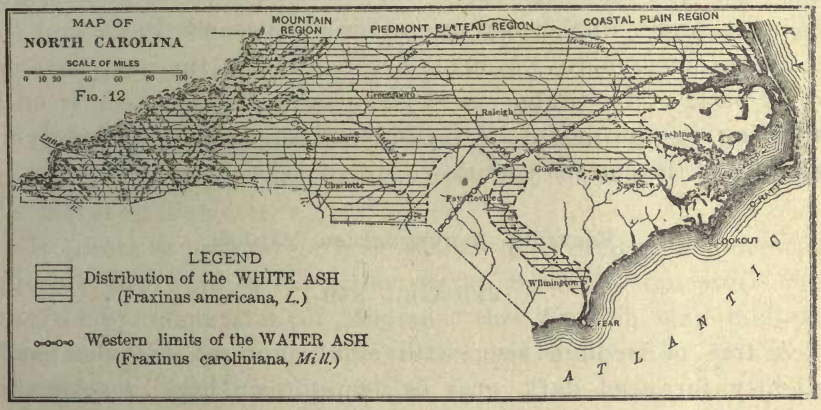
*Halesia tetraptera, Linnæus.

WHITE ASH

or spreading branches and grayish furrowed bark, reaching a height of 120 and a diameter of 6 feet. (Plate VI.)

It grows in low, rather moist soil, from Nova Scotia to northern Minnesota, southward to northern Florida, central Alabama and Mississippi, and west to eastern Nebraska, Kansas, Indian Territory, and eastern Texas; reaching its best development in the basin of the Ohio river.

In North Carolina, where it grows to an average height of 50 to 80 and a diameter of 2 to 3 feet, it occurs throughout the State. (Fig. 12.)



The white ash produces seed abundantly about every 3 or 4 years, though individual trees along streams, or when isolated, bear more frequently. The young seedlings, which are not common, stand shade well, and are usually found in moist situations, often at a considerable distance from the parent tree. Large trees are usually sound, but sometimes have large heart-cracks. In the mountains a mixed growth of oaks, lin, and buckeye replace the white ash after lumbering. The timber is attacked while still standing, especially when growing in swamps, by Fatua denudata, Harris, the ash sesia.

The leaves are composed of 5 to 9, usually 7, stalked leaflets. The inconspicuous flowers appear before the leaves in spring, the male and female on separate trees, and the narrow-winged fruit is 1½ to 2 inches long. The rust-colored winter-buds are covered

with short hairs. The ash has numerous deep-seated lateral roots.

The wood is heavy, hard, strong, coarse-grained, tough, becoming brittle with age; the heartwood brown; the sapwood nearly white. It is extensively used for agricultural implements, wagon-making, handles, oars, cabinet and interior work, and by shipwrights, turners, and coopers.

Large quantities have been sawed in the mountains of this State, chiefly for lumber and furniture. Asheville, Dillsboro, and Elk Park are important centres for the manufacture of ash lumber. In 1892 about 8,000,000 feet was sawed in the mountain counties and shipped mainly to Cincinnati and Philadelphia. About as much more was manufactured during the same year in other parts of the State. A large amount of white ash is still standing in the mountain region and in some of the river swamps of the eastern counties.

Fraxinus pennsyvanica, Marshall.

(RED ASH. ASH.)

A tree of medium size, with stout, upright branches and slightly furrowed dark gray or deep brown bark, reaching a height of 60 feet and a diameter of 20 inches.

It occurs in rich moist ground from New Brunswick to southern Ontario and northern Minnesota, and southward to northern Florida and central Alabama; attaining its best development in the northern Atlantic states. It is rare west of the Alleghany mountains.

In this State, where it grows to a height of 50 to 60 feet, it is confined to the Piedmont plateau.

The red ash produces seed about as often as the white ash, but seedlings are less common and confined principally to the neighborhood of water courses. Numerous sprouts spring up after cutting, but do not develop into large trees. Birch, white oak and red maple usually form the growth after lumbering.

The leaflets are 7 to 9 in number, obscurely toothed, narrowed at the apex into long, slender points, lustrous on the upper sur-

face, and downy beneath; the leafstalks also covered with a silky down. The male and female flowers appear on separate trees late in spring, and the narrow-winged fruit is like that of the white ash, except that the end of the wing is usually more rounded. The dark, russet-brown rounded winter-bud is downy. The red ash has numerous lateral and superficial roots.

The wood is heavy, hard, strong, brittle, close-grained and compact, rich brown in color; the sapwood light brown streaked with yellow. It is used for paper pulp and for the same purposes as that of the white ash, to which it is inferior.

Fraxinus pennsylvanica var. **lanceolata**, Sargent.

(GREEN ASH. ASH.)

A tree of medium size, with slender, spreading branches and gray or dark brown bark, rarely exceeding 60 feet in height and 24 inches in diameter.

It occurs in low, rather moist soil, from Vermont to northern Florida, westward to the valley of the Saskatchewan river and the Rocky mountains of Montana, the Wasatch mountains of Utah and the eastern and northern ranges of Arizona. It is most abundant in the Mississippi basin.

It is not a common tree in North Carolina, and is confined to the upper part of the coastal plain and to the Piedmont plateau, where it reaches a height of 60 and a diameter of 2 feet.

The leaflets are smooth and bright green on both sides, and narrower, shorter, and often more sharply toothed than those of the red ash. In the West the species and variety are connected by many intermediate forms. East of the Mississippi river the trees are quite distinct.

The wood is heavy, hard, strong, brittle, rather coarse-grained; brown in color; the thick sapwood lighter. It is inferior in quality to the wood of the white ash, but in this State is not distinguished from it commercially.

Fraxinus caroliniana, Miller.

(WATER ASH.)

A small tree, with slender branches which form a narrow top,

and light gray furrowed bark, reaching a height of 40 feet and a diameter of 12 inches.

It occurs in deep river swamps from southeastern Virginia near the coast to Florida, westward through the Gulf states to the valley of the Sabine river, Texas, and southwestern Arkansas. It is also found in Cuba.

In North Carolina, where it reaches an average height of 30 to 40 feet, it is confined to the deep swamps of the coastal plain region. (Fig. 12, p. 71.)

It bears seed abundantly every year or two. Trees in deep swamps have swollen butts which are usually hollow, but as a general rule the upper part of the stem is sound.

The leaves are composed of from 5 to 7 large, long-stalked leaflets. The male and female flowers appear in February and March upon separate trees. In the fruit the wings extend to the bottom of the seed, and are sometimes three in number. The winter-buds are chestnut-brown in color. The water ash has numerous deeply seated lateral roots.

The wood is light, soft, not strong, brittle, close grained, and compact; the heartwood nearly white, sometimes tinged with yellow; the sapwood lighter. It is of less value than that of many of the other ashes.

In the eastern section of North Carolina it is largely manufactured into lumber. The best logs are usually sawed into furniture squares.

Persea borbonia, Sprengel.

(RED BAY. SWEET BAY.)

An evergreen tree, with dark brown-green branches and deeply furrowed reddish bark, reaching a height of 70 and a diameter of 3 feet.

It occurs in low rich soil from southern Delaware south to Bay Biscayne and Cape Romano, Florida, and through the Gulf states to southern Arkansas and the valley of the Brazos river, Texas, near the coast.

In this State it is a small tree or shrub, and occurs in the coastal plain region. Old trees over 8 inches in diameter are frequently hollow.

The oblong entire evergreen leaves are 2 to 3 inches long and, like the twigs, have an aromatic odor when bruised. The flowers are small and in close panicles, and the fruit is an ovate 1-seeded deep blue drupe. The small dark brown winter-buds and dark twigs are downy. The red bay has a lateral root system.

The wood is heavy, hard, very strong, brittle, very close-grained, and compact; bright red in color; the sapwood much lighter. It takes a beautiful polish, and was formerly somewhat used in ship-building, interior finish and cabinet work.

Sassafras sassafras, Karsten.

(SASSAFRAS.)

A large tree, with green or yellowish-green branchlets and furrowed gray bark. It sometimes reaches a height of 90 and a diameter of 7 feet, but is reduced to a shrub at its northern limit.

It occurs from eastern Massachusetts and southwestern Vermont, west through southern Ontario and central Michigan, to southeastern Iowa, eastern Kansas, and Indian Territory, and south to middle Florida and the valley of the Brazos river, Texas; reaching its best development in southwestern Arkansas and Indian Territory.

In this State, where it rarely exceeds 40 to 50 feet in height, it is most common in the coastal plain and Piedmont plateau regions, and rare on the higher slopes of the mountains.

Seed is produced at frequent intervals, and young seedlings are common in old fields when protected from fire. Sprouts spring readily from the stumps of young trees and from the spreading roots, and in many cases become large trees.

The leaves are very variable, being ovate and entire, or 2 to 3-lobed. The greenish-yellow clustered flowers appear in early spring, the sterile and fertile on separate trees, and the oval fruit is blue in color, with a thick reddish stem. The egg-shaped winter-buds are large.

The wood is light, soft, weak, brittle and coarse-grained, very durable in contact with the soil, and apt to check in drying. It is slightly aromatic. The heartwood is dull orange-brown in color; the thin sapwood light yellow. It is used in boat building, fencing, cooperage, and for ox yokes. An aromatic stimulant is derived from the bark of the root.

Ulmus americana, Linnæus.

(AMERICAN ELM.)

A large tree, with short spreading or long pendulous branches and scaly dark brown trunk, reaching a height of 120 and a diameter of 11 feet.

It occurs in rich moist soil from southern Newfoundland to the northern shores of Lake Superior and the eastern slope of the Rocky mountains, south to Florida, and west to Dakota, central Nebraska, Indian Territory, and Texas; reaching its best development in the northeastern United States.

In this State, where it reaches an average height of 60 to 70 and diameter of 4 to 5 feet, it occurs abundantly in most of the swamps

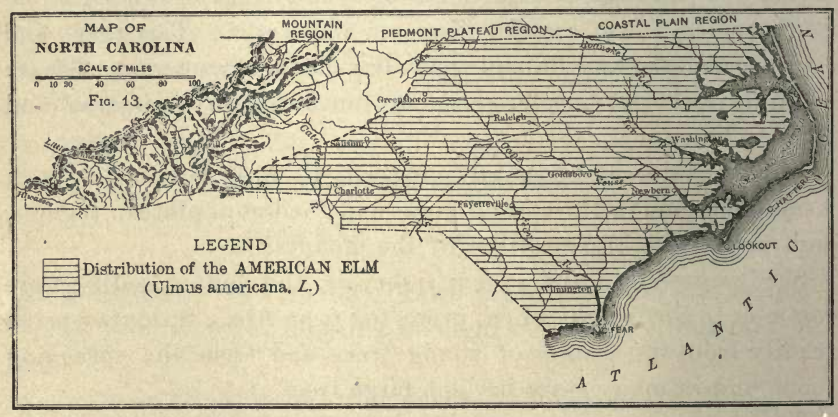


Fig. 13.

of the coastal plain and extends westward as far as Guilford and Mecklenburg counties. (Fig. 13.) It is smaller and much less common toward its western limit.

Seed is borne generally every year in abundance, and young plants are common in damp open places. The American elm does not sprout readily from the stump.

A larva of a longicorn beetle, Saperda tridentata, Oliver, loosens the inner bark and channels the surface of the wood so as frequently to kill the tree. The American elm also suffers severely from canker-worms, Paleacrita vernata, Peck, and Eugonia subsignaria, Huebner, and the imported elm-leaf beetle, Galeruca scanthomelæna, Schrank, all of which feed upon and destroy the foliage.

The leaves are usually smaller and less rough than those of the slippery elm. The small greenish-brown flowers are in numerous lateral clusters and appear early in spring. The flattened oval winged fruit is hairy on the margin, and ripens and falls before the leaves appear. The buds are smooth, rather small and acute. The American elm has long, well developed lateral roots.

The wood is heavy, hard, strong, tough, rather coarse-grained, compact, and difficult to split; the heartwood light brown; the sapwood lighter. It is used for wheel stocks, saddle-trees, flooring, and cooperage, and is exported for boat and ship-building.

In North Carolina the wood of this tree is not much used, and very little of it has ever been cut.

Ulmus alata, Michaux.

(WINGED ELM. WAHOO. CORK ELM. SOUTHERN ELM.)

A small tree, with slender branches and close finely ridged light brown bark, reaching a height of 50 and a diameter of 2 feet.

It occurs on dry gravelly or often on moist soil from southern Virginia, through the middle districts to western Florida, southern Indiana and Illinois, south to the Gulf coast, and southwest through southern Missouri, Arkansas, and the eastern portion of Indian Territory and Texas; reaching its best development in southern Missouri and Arkansas.

In this State, where it reaches an average height of 30 to 45 feet, it grows along swamps and streams, and is nowhere uncommon except on the mountains. (Fig. 14.)

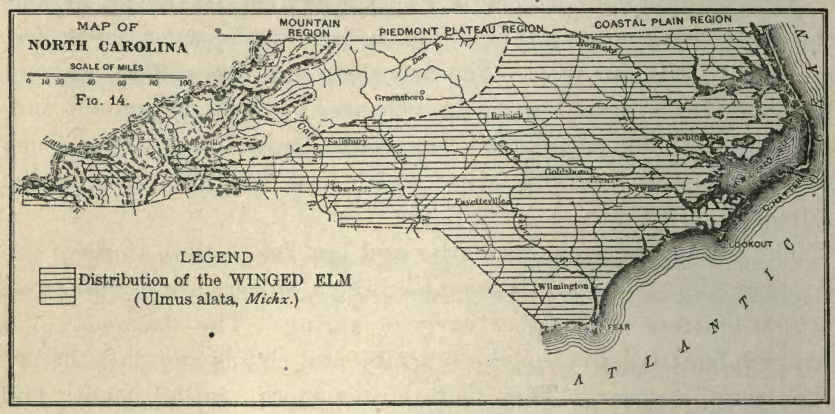


Fig. 14.

The winged elm bears seed abundantly at intervals of 2 or 3 years, and young plants are frequent along streams or swamp land.

The leaves are smaller than those of the American elm and the brown twigs more slender. The small clustered flowers are on slender foot-stalks, and the oval winged fruit is deeply notched, and hairy on the margin. There are numerous long superficial lateral roots.

The wood is heavy, hard, not strong, very close-grained, compact, unwedgeable; brown in color; the sapwood lighter. It is used for hubs, blocks, and tool handles.

Ulmus fulva, Michaux.

(SLIPPERY ELM.)

A tree, with deeply furrowed dark brown bark and dark gray-brown branches which form a broom-shaped crown, reaching a height of 135 and a diameter of 4 feet.

It occurs in rich soil from the valley of the lower St. Lawrence river to northern Dakota, and south to northern Florida, central Alabama and Mississippi, and the valley of the San Antonio river, Texas.

In this State, where it reaches an average height of 30 to 50

feet and a diameter of 12 to 18 inches, it is most plentiful in the Piedmont plateau, less so among the mountains, and is found occasionally in the coastal plain region.

The slippery elm produces seed at rather irregular intervals of 2 to 4 years, and for the most part not abundantly. Young seedlings are rare except in damp, somewhat shaded places near the parent tree.

The thick ovate oblong coarsely toothed leaves are very rough on the upper surface and downy beneath. The flowers occur in lateral clusters on short foot-stalks, and the flat-winged fruit is round, but not fringed. The rounded reddish-brown winter-buds are hairy. The slippery elm has numerous deeply seated lateral roots.

The wood is heavy, hard, strong, very close-grained, compact, and durable in contact with the soil. The heartwood is dark brown or red; the sapwood lighter. It is used for wheel-stock, fencing, railroad ties, sills, and in shipbuilding. The mucilaginous inner bark is medicinal.

Morus rubra, Linnæus.

(RED MULBERRY.)

A tree, with dark brown, much-broken bark and smooth gray branches, reaching a height of 65 and a diameter of 7 feet.

It is found generally in rich soil from western Massachusetts and Long Island, N. Y., through southern Ontario, central Michigan, and the Black Hills of Dakota, eastern Nebraska and Kansas, south to southern Florida, and the valley of the Colorado river, Texas; reaching its best development in the basins of the lower Ohio and Mississippi rivers.

In this State, where it grows to an average height of 30 to 50 and an average diameter of 1 to 2 feet, it is found throughout, being most abundant on the Piedmont plateau and very rare in the mountain region.

The red mulberry bears large quantities of seed every year or every other year, and seedlings are found on moist soil through the forests of the Piedmont plateau region. Numerous sprouts come up after cutting.

The broad, heart-shaped, pointed leaves are rough above and downy below. The flowers are inconspicuous, and the deep red or purple fruit is sweet and edible, with an agreeable, slightly acid taste. The winter-buds are large, reddish, smooth and conical.

The wood is light, soft, not strong, rather tough, coarse-grained, compact, very durable in contact with the soil, light orange-yellow in color; the sapwood lighter.

It takes a good polish, and is largely used for fencing, cooperage, snaths, and, at the South, for ship and boatbuilding. The leaves have been used for feeding silkworms, but are not well adapted for that purpose.

Celtis occidentalis, Linnæus.

(HACKBERRY.)

A large tree, with bark often much roughened by small ridges, and flexuous, smooth, brown branches. It reaches a height of 130 and a diameter of 5 feet, or sometimes is reduced to a low shrub.

It occurs in rich bottoms or on dry hillsides from the valley of the St. Lawrence river west to eastern Dakota, south through the Atlantic region to southern Florida, and to Texas; being most abundant and reaching its best development in the basin of the Mississippi river.

In this State, where it reaches an average height of 50 to 70 feet and a diameter of 18 to 20 inches, it is found throughout, except in the high mountain counties, as Ashe, Watauga, Mitchell, and Yancey, and attains its greatest size and abundance in the alluvial swamps of the coastal plain.

It bears seed plentifully and as a rule every year. Seedlings are common near old trees and along river bottoms.

The leaves are ovate, toothed, taper-pointed, and smooth at maturity. The greenish flowers are inconspicuous, and the

rounded, purplish-red fruit, from ¼ to ⅓ inch in diameter, is sweet and edible.

The wood is heavy, rather soft, not strong, coarse-grained, compact, clear light yellow in color; the sapwood, lighter. It takes a good polish, and is largely used for fencing, and occasionally in the manufacture of cheap furniture.

Platanus occidentalis, Linnæus.

(SYCAMORE. BUTTONWOOD.)

A large tree, with deep brown smooth bark, scaling off in thin, brittle plates, leaving the tree a mottled polished white, or with bark uniform and rough. It reaches a height of 130 and a diameter of nearly 14 feet.

It occurs in rich moist soil, generally near streams, from southern Maine and the northern shores of Lakes Ontario and Erie west to eastern Nebraska and Kansas, south to northern Florida, central Alabama, Mississippi, and southern Texas; reaching its best development in the bottom lands of the Ohio and Mississippi rivers. It is a very common tree.

In this State, where it reaches a height of 90 and a diameter of 5 or 6 feet, it occurs throughout, growing to its best size along the alluvial swamps of the Piedmont plateau. It is least abundant on the coastal plain.

The sycamore bears fruit in abundance and usually every year, and seedlings are common along streams. Old trees are generally hollow at the butt. It sprouts very freely from the stump, and is easily propagated from cuttings. The growth is very rapid.

The large broad leaves are angularly lobed and toothed, downy when young, and smooth at maturity. The male and female flowers occur in separate small spherical heads with slender stems. The fruit is a globular head one inch in diameter, hanging on the tree through the winter. The short, broad, pyramidal buds are formed beneath the swollen base of the leafstalks. The sycamore has numerous long running roots.

The wood is heavy, hard, not strong, very close-grained, com-

pact, difficult to split and work; brown in color; the sapwood lighter. It decays rapidly in contact with the soil or on exposure, and warps and cracks badly in drying. It is used for ox yokes, butchers' blocks, for interior finish, and in the manufacture of furniture, and very largely for tobacco boxes.

Juglans cinerea, Linnæus.

(WHITE WALNUT. BUTTERNUT.)

A large tree, with dark granite-gray furrowed bark and light gray smoothish branches, reaching a height of 115 and a diameter of 3 feet.

It occurs in rich woodlands, from southern New Brunswick, the valley of the St. Lawrence river and Ontario, to Dakota and Nebraska, southward to Delaware, Missouri, and Arkansas, and along the Alleghany mountains to Georgia and Alabama; reaching its best development in the basin of the Ohio river.

In North Carolina it occurs through the mountains and sparingly through the upper part of the Piedmont plateau, but is nowhere common. In certain cool, rich mountain valleys it attains a height of 70 and a diameter of 3 feet. (Fig. 15, p. 83.)

The white walnut bears fruit abundantly only every 2 or 3 years, and young seedlings are uncommon. Young trees sprout freely from the stump; old ones less readily.

The leaflets are 11 to 17 in number on the sticky leafstem, rounded at the base, taper-pointed, sharply toothed, and downy on the lower surface. The sterile flowers are in large green catkins, the fertile flowers small and inconspicuous. The brown fruit is 2 to 3 inches long, very sticky, and contains an edible nut. The naked winter-buds are light brown, blunt, and covered with soft down; the terminal buds large and conspicuous, the lateral buds much smaller, two or three together above each leaf-scar. There are numerous strong superficial lateral roots, while the taproot in specimens over 10 inches in diameter is poorly developed.

The wood is light, soft, not strong, coarse-grained, compact, and easily worked; light brown in color; the sapwood, lighter. It

takes a beautiful polish, receives paint well, and is used for interior finish, cabinet work, panels of carriages, and occasionally for the lower framework of buildings. The inner bark yields a yellow dye, and is employed as a mild cathartic.

Juglans nigra, Linnæus.

(BLACK WALNUT.)

A large tree, of the first commercial value, with a small oval crown and rough very dark brown bark, reaching a height of 150 and a diameter of 10 feet or more.

It occurs from western Massachusetts to eastern Nebraska and Kansas, and south to northern Florida, Alabama, Mississippi, and the valley of the San Antonio river in Texas; reaching its best development in the rich bottom lands of southwestern Arkansas and Indian Territory, and on the western slopes of the southern Alleghany mountains.

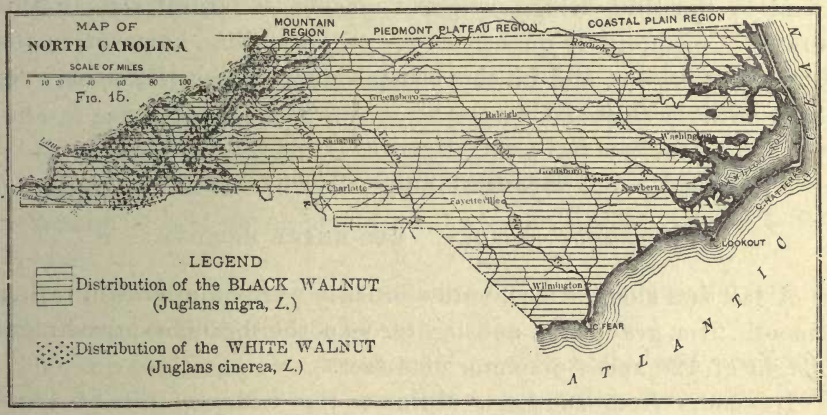


FIG. 15.

In this State, where it grows to an average height of 40 to 50 feet, it is most abundant on the Piedmont plateau, but is found throughout. (Fig. 15.)

Forest trees bear seed abundantly only every 3 or 4 years, and young seedlings are not common except near mature trees in low fertile rather open lands or in fields and meadows which border streams. The growth is very rapid until a large size is reached,

especially when the soil is good and the light conditions favorable. Only small trees send up from the stump shoots, which attain a large size.

The leafstalk is slightly downy but not sticky; the leaflets 15 to 23 in number, smooth above and somewhat downy beneath. The fruit is round, greenish-yellow when ripe, about 2 inches in diameter, and contains a nut with an edible kernel. The large terminal buds are covered with a light brown tomentum and the lateral buds are above the leaf scars as in the preceding species. The black walnut has a well-developed taproot and numerous strong lateral roots.

The wood is heavy, hard, strong, rather coarse-grained, liable to check, easily worked, and durable in contact with the soil; rich dark brown in color; the thin sapwood much lighter. It takes a beautiful polish, and is used for cabinet making, interior finish, gunstocks, and in boat and shipbuilding. The husk of the fruit yields a dye.

The black walnut has been largely removed from the counties west of the Blue Ridge, where it reaches its largest size in this State. Considerable quantities are still standing, however, in the Piedmont region, and in the coastal plain region it has not yet been entirely removed.

Hicoria minima, Britton.*

(BITTERNUT HICKORY. RED-HEART HICKORY.)

A tall and slender tree, with a broadly pyramidal crown, rather smooth, firm, gray bark, and lighter smoother branches, reaching a height of 120 and a diameter of 4 feet.

It occurs from southern Maine to the valley of the St. Lawrence river, westward through Ontario, central Michigan and Minnesota, and the eastern parts of Nebraska, Kansas, and Indian Territory, and southward to western Florida and eastern Texas; reaching its best development in Pennsylvania and Ohio.

In North Carolina it grows to an average height of 80 and a diameter of 2 to 3 feet, and occurs in moist, cool situations, on

*Carya amara, Nuttall.

loamy or clay soils in all parts of the State, but is abundant only in the mountains, where it is the largest and most common hickory.

The fruit is borne plentifully at short intervals, and seedlings are frequent in the mountains, especially in moist open woods.

The leaves consist of 5 to 9 small, narrow, acute, smoothish leaflets. The dark green fruit is rounded or slightly egg-shaped, with a very thin husk, opening half way down when ripe. The shell of the white, smooth nut is so thin that it can be broken with the fingers. The kernel is intensely bitter. The yellow winter-buds are small, elongated, and slightly rounded or pointed.

The wood is heavy, very hard, strong, and tough, and checks badly in drying; dark brown in color; the sapwood lighter, or often nearly white. The wood is inferior to that of the other hickories, but is used for hoops, ox yokes and fuel.

Hicoria aquatica, Britton.

(WATER-BITTERNUT HICKORY. WATER HICKORY. SWAMP HICKORY.)

A tree, with rough, somewhat furrowed bark, reaching a height of 100 and a diameter of 3 feet, or generally much smaller.

It occurs from Virginia through the coast region to Florida, along the Gulf shore to Texas, and northward to southern Illinois; reaching its best development on the lower Mississippi and Yazoo rivers.

In this State, where it is confined to the coastal plain, it grows to an average height of 40 to 50 feet. (Fig. 16, p. 86.)

Young seedlings are uncommon in this State, and are found only on alluvium, and then usually in spots where trees have been cut.

There are 7 to 13 smooth, pointed, slightly toothed leaflets. The fruit is roundish, with a thin husk 4-parted to the base. The thin-shelled, 4-angled nut contains a very bitter kernel. The flattened winter-buds are covered with a rusty down. The water-bitternut hickory has a poorly developed taproot and numerous strong lateral roots.

The wood is heavy, soft, strong, rather brittle, very close-grained, and compact; the heartwood, dark brown; the sapwood lighter, often nearly white. The timber is of an inferior quality, and is chiefly used for fencing and fuel. It is rare in North Carolina, and, from the difficulty in getting it out of the swamps, it is little used.

Hicoria ovata, Britton.

(SHAG-BARK HICKORY. SHELL-BARK HICKORY. SCALY-BARK HICKORY.)

A large tree of great commercial value, with pendulous branches, and grayish-brown bark separating from the trunk in long strips. It reaches a height of 150 and a diameter of 4 feet.

It occurs on rich hillsides and on sandy ridges from the valley of the St. Lawrence river to Michigan and southeastern Minnesota, southward to western Florida, central Alabama and Mississippi, and westward to eastern Kansas, Indian Territory, and eastern Texas; reaching its best development west of the Alleghany mountains. A common tree.

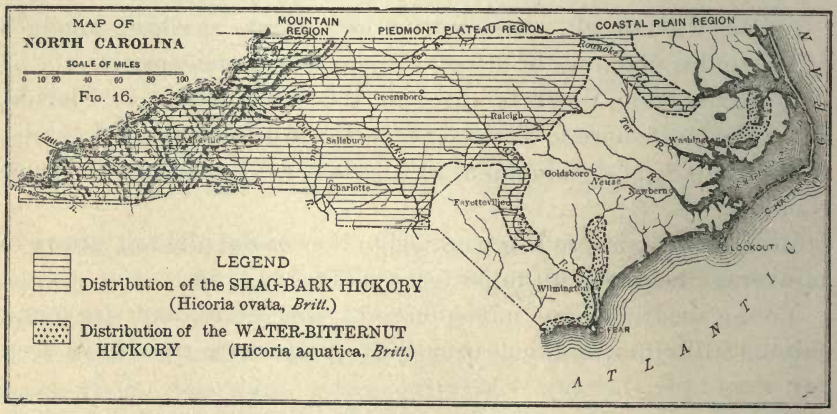


Fig. 16.

In this State, where it attains an average height of 60 to 80 feet and an average diameter of 15 to 20 inches, it occurs throughout but is nowhere common, and least so in the coastal plain region. (Fig. 16.)

* Carya alba, Nuttall.

Seed is borne frequently and in large quantities, but seedlings are not common except in the Piedmont plateau, and young trees are infrequent in second-growth woods.

The leaves are large and composed of 5 to 7-pointed, rather coarsely toothed leaflets, the lower pair small and narrow, the upper pair and terminal leaflet very large, broad and inversely egg-shaped. The barren flowers are in slender, pendulous, green tassels, three on a common stalk. The minute fertile flowers are in groups of 2 to 4 together on the ends of the shoots. The thick husk of the nearly globular fruit separates into four distinct pieces, and the nut is white, sweet, edible, and 4-angled. The large, yellowish-brown, scaly buds are egg-shaped.

The shag-bark hickory has numerous lateral roots and a strong taproot which is developed in early youth.

The wood is heavy, very hard and strong, tough, close-grained, compact, and flexible; light brown in color; the thin and more valuable sapwood nearly white. It is largely used for agricultural implements, carriages, axe and tool handles, baskets and fuel.

Hicoria alba, Britton.*

(WHITE HICKORY. BIG-BUD HICKORY. MOCKERNUT.)

A tree, with dark ashen-gray, deeply furrowed bark, reaching a height of 108 and a diameter of 4 feet.

It occurs from southern Ontario to the eastern parts of Nebraska, Kansas, and Indian Territory, southward to central Florida and the valley of the Brazos river, Texas. It grows on rich hillsides or in low river bottoms, and is very common in the Gulf states and throughout the South.

In North Carolina, where it grows to an average height of 60 feet and a diameter of 18 to 20 inches, it is common throughout the State. (Fig. 17, p. 88.)

The white hickory bears fruit frequently and in abundance. Seedlings are common near old trees and in second-growth woods, and often in dry or moist uplands a considerable part of the forest is composed of young trees of this species. Young

*Carya tomentosa, Nuttall.

trees, when cut down or killed by fire, send up numerous sprouts from the stump. Late spring frosts are very injurious to this species, frequently checking the growth of the new twigs and at times killing the tree.

The leaves are very large and consist of 7 to 9 leaflets, the lower surface of which, as well as the recent shoots and leafstems, are downy when young. The fruit is oval, nearly round or slightly pear-shaped, and 1½ to 2 inches or more in length. The husk splits nearly to the base when ripe. The thick-shelled, somewhat 6-angled nut contains a small and unusually sweet kernel. The winter-buds are large, round, and covered with downy, hard, grayish-white scales.

The wood is heavy, very hard, strong, tough, very close-grained, and flexible, and checks in drying. The heartwood is rich dark brown; the thick sapwood nearly white. It is used for the same purposes as the wood of the shag-bark hickory. (Page 86.)

Hicoria glabra, Britton.

(PIGNUT.)

A large tree, with an oval head and firm, close, rough, gray bark on the trunk, and smoother, lighter bark on the branches. It reaches a height of 130 and a diameter of 5 feet.

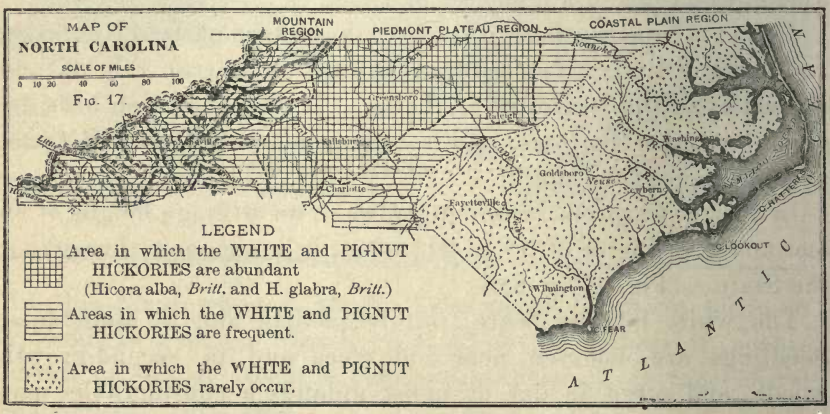


FIG. 17.

It occurs on dry hills and uplands from southern Maine to southern Ontario, southern Michigan, Minnesota, the eastern parts

WHITE OAK

of Nebraska, and Indian Territory, and south to western Florida and southern Texas; reaching its best development in the lower Ohio basin.

In this State, where it reaches an average height of 70 to 80 feet, it is found throughout. It is not a common tree in the mountains, and is rare in the coastal plain region; but along with the white hickory it is fairly abundant in the Piedmont plateau region. (Fig. 17, p 88.)

The pignut bears fruit frequently and in large quantities, and young growth is common near the parent trees and through second-growth woods.

The leaves are long, with 5 to 7 smooth leaflets. The smooth, tapering twigs are smaller than in the two preceding species. The fruit is pear-shaped or rounded, with very thin husks splitting about halfway to the base. The rather thin-shelled nut, about ½ inch in diameter, contains a small sweetish or slightly bitter kernel. The polished brown winter-buds are egg-shaped and pointed or rounded It has numerous lateral roots and a taproot which is developed early in the life of the tree.

The wood is heavy, hard, very strong, and tough, flexible and close-grained, and checks in drying; dark or light brown in color; the thick sapwood lighter, often nearly white. Its uses are the same as those of the shag-bark hickory, to the wood of which species for some purposes it is preferred.

Quercus alba, Linnæus.

(WHITE OAK.)

A large tree, of great economic value, with large spreading branches and a bark which is either light gray, slightly roughened, and in the older trees, loosens in large thin scales, or is gray, firm, and deeply furrowed. It reaches a height of 150 and a diameter of 8 feet. (Plate VII.)

It occurs on all soils from northern Maine to the valley of the St. Lawrence, westward through lower Michigan to southeastern Minnesota, and southward to St. John's river and Tampa bay, Florida, and the valley of the Brazos river, Texas; reaching its

best development on the slopes of the Alleghany mountains, and in the valley of the Ohio river and its tributaries. It is a common tree in a considerable portion of the central and eastern states.

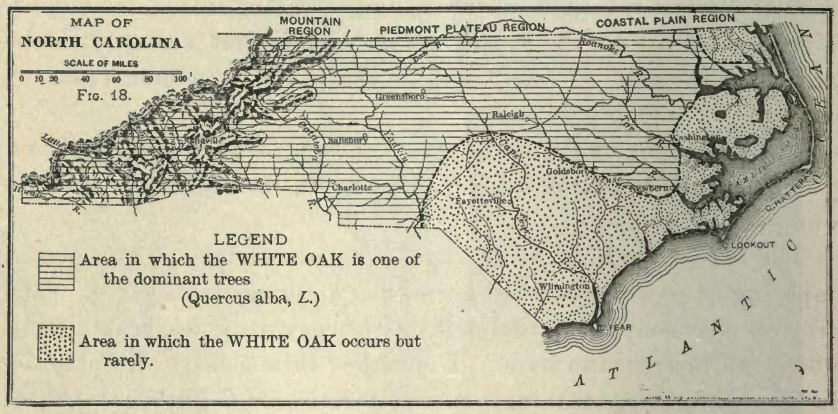


Fig. 18.

LEGEND

Area in which the WHITE OAK is one of the dominant trees (Quercus alba, *L.*)

Area in which the WHITE OAK occurs but rarely.

In North Carolina, where it attains an average height of 70 to 80 and an average diameter of 4 to 5 feet, it occurs throughout, and is common everywhere except in the northeastern part of the State and on the sandy soils of the southeastern section. It is most plentiful on the Piedmont plateau. (Fig. 18.)

Large quantities of seed are produced about once in three years. The acorns germinate in all kinds of soil and frequently seed up old fields. Young seedlings are common in all situations, and bear well either the deep shade of the old tree or full exposure to the sun. Young white oaks are apt to form a large part of the new growth after the removal of the yellow poplar, shortleaf pine or the white oak itself. In many parts of the original forest, on poor soil, white oak is the predominant tree, and it generally forms a large part of second growth of mixed hardwoods. Small trees sprout freely and vigorously from the stump. Individuals over 3 inches in diameter are not easily killed by fire. Large trees are rarely hollow. Though a large number of insects live on the white oak, it is not seriously injured by borers or insects which attack the leaves or twigs. A weavil frequently destroys the acorns.

The leaves are acute at the base, with 7 to 9 blunt, rounded, usually entire lobes. The male flowers are in long slender threads,

the female very minute. The acorns, usually in pairs, have rounded saucer-shaped, rough, warty cups, and brown, sweet, edible nuts. The small blunt winter-buds are smooth, as are the light brown or gray slender twigs. The white oak has a taproot and numerous deeply seated lateral roots.

The wood is strong, very heavy, hard, tough, close-grained, liable to check, and very durable in contact with the soil; brown in color; the sapwood lighter. It is used for shipbuilding, construction, cooperage, carriages, agricultural implements, railway ties, fencing, interior finish, cabinet-making, baskets, fuel, etc. It is altogether one of the most important timbers of the United States.

In North Carolina it is largely used for fuel, clapboards, fencing, ties, and staves. It has been manufactured into lumber for local uses only. Large quantities of merchantable timber still stand in the mountain counties and in many of the counties of the Piedmont plateau. The bark is used extensively for tanning, but is less highly valued than that of the chestnut oak.

Quercus minor, Sargent.

(POST OAK.)

A tree, with rough hard gray bark, and numerous spreading branches, reaching a height of 100 and a diameter of 5 feet; or on the Florida coast reduced to a low shrub.

It occurs generally in poor soil from Massachusetts south to northern Florida, and west through southern Ontario and Michigan to eastern Nebraska, Kansas, and Indian Territory, and into central Texas, and is very common in the Gulf states west of the Mississippi.

In this State, where it grows to a height of 50 and a diameter of 4 feet, it occurs in greatest numbers and attains its largest size in the Piedmont counties. Here it forms with the white oak a large part of the second-growth in the forest and in old fields. It is not common in the transmontane counties. In the eastern section it frequently forms, on the margins of swamps, a lower story beneath the willow and water oaks. (Fig. 19, p. 92.)

The post oak bears fruit abundantly every 2 or 3 years, and

young plants are common in thinned and second-growth woods, bearing well both deep shade and strong light. It does not

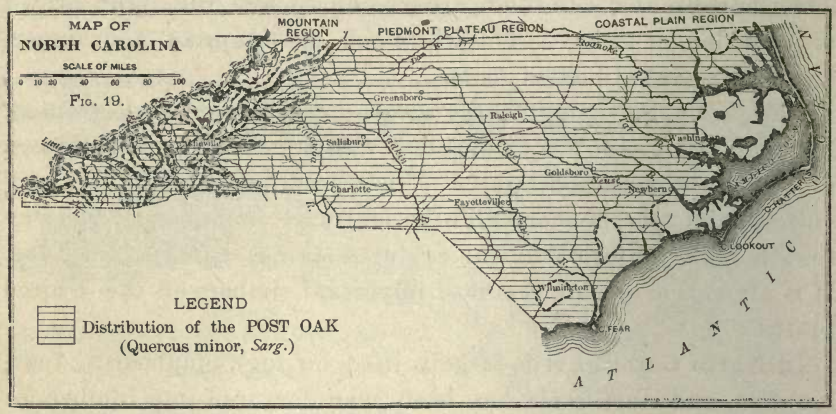


Fig. 19.

sprout as freely as white oak. Although in favorable situations the growth is rapid, in general it grows more slowly than the white oak.

The leaves are stiff, leathery, rough above, whitish and downy below, and divided into 5 to 7 roundish divergent lobes, the upper lobe large and often double. The acorns, borne on short foot-stalks, are small and sweet, and seated in deep, grayish, smooth-scaled cups. The winter-buds are small, rounded, smooth, and dark brownish-red.

The wood is heavy, hard, close-grained, compact, checks badly in drying, and is very durable in contact with the soil; dark or light brown in color; the sapwood lighter. It is used for construction, cooperage, shipbuilding, fencing, railroad ties, fuel, and occasionally for carriage stock. Large quantities have been cut in the Piedmont section for staves, and it is extensively used throughout the middle and eastern counties for posts, ties, etc.

Quercus lyrata, Walter.

(OVERCUP OAK. SWAMP POST OAK.)

A large tree, with rough flaky gray bark, and smooth gray small often pendulous branches, reaching a height of 100 and a diameter of 3 feet.

It occurs in wet soil, from Maryland southward near the coast,

to western Florida, westward through Alabama, Mississippi, and Louisiana, to the valley of the Trinity river, Texas, and through Arkansas and southeastern Missouri to middle Tennessee, southern Indiana, and Illinois; reaching its best development in the valley of the Red river and adjacent portions of Arkansas and Texas. It is rare in the Atlantic states.

In North Carolina it occurs on the oak flats of the coastal plain, and in the alluvial swamps of the rivers as far inland as Anson, Orange, and Nash counties. (Fig. 20.)

The overcup oak bears acorns plentifully at intervals of 3 or 4 years, but young seedlings are infrequent. The fruit is devoured by swine, and the young plants are destroyed by browsing cattle.

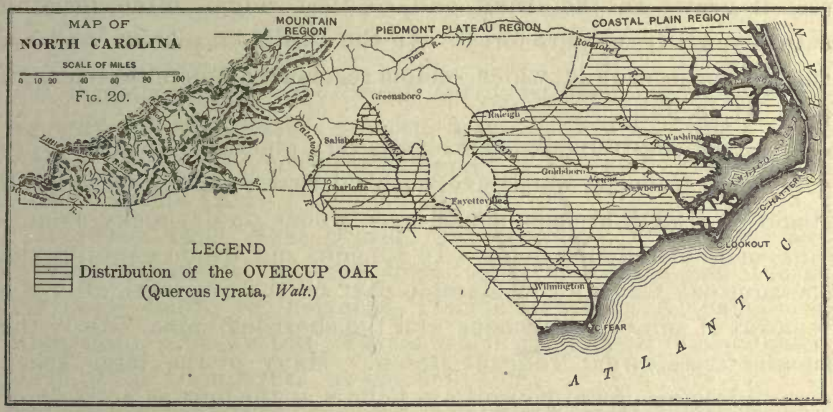


FIG. 20.

The leaves are oblong, crowded at the ends of the branchlets, and 7 to 9-lobed, the divisions acute or blunt, entire or somewhat toothed. The large subglobose acorn is nearly covered by the scaly, thin, rugged, fringed cup. The light chestnut-brown winter-buds are small and egg-shaped. The overcup oak has a tap-root and many rather deeply seated lateral roots.

The wood is heavy, hard, strong, tough, close-grained, and inclined to check, and very durable in contact with the soil; rich dark brown in color; the sapwood lighter. It is used for the same purposes as that of the white oak. Very little of this timber has ever been cut.

Quercus prinus, Linnæus.

(ROCK CHESTNUT OAK. CHESTNUT OAK. BUCK OAK.)

A large tree, with deeply furrowed dark gray bark, and a

broadly oval crown, reaching a height of 100 and a diameter of 4 feet.

It occurs from southern Maine to the shores of Lake Champlain, Quinte bay, Ontario, and the valley of the Genesee river, New York, south to Delaware, and through the Appalachian mountain region to northern Alabama, extending westward to central Kentucky and Tennessee.

In North Carolina it is found on dry soil and on the tops of ridges westward from Franklin and Montgomery counties. It reaches its best development on the slopes of the lower mountains at an elevation of 2,000 to 4,000 feet, where with other oaks and the chestnut it constitutes a large part of the forest. Above 4,000 feet it grows on the driest and rockiest ridges, often forming extensive groves of pure forest. In the Piedmont plateau region a smaller form is found, which seldom reaches a diameter of one foot. (Fig. 21, p. 95.)

The rock chestnut oak bears acorns very plentifully nearly every year, or in the deep woods every second year. Young trees in all stages of growth are common in open woods on dry rocky mountains or in abandoned fields. In Lincoln and Union counties the chestnut oak forms a considerable part of the regrowth after the removal of mixed hardwoods and the short-leaf pine. Only the smaller trees sprout from the stump. Many of the large specimens growing upon dry soil are hollow at the butt as a result of frequent fires. Borers often penetrate the lower parts of the stems of small trees which occur on dry ground, but trees in damp situations are nearly always sound.

The leaves are upon short stems, usually broadest toward the extremity, and with 6 to 13 large rounded teeth on each side. The acorns are large and oval, with thick, warty cups. The large blunt winter-buds and the twigs are smooth. The numerous, branching roots penetrate deeply into the soil.

The wood is heavy, hard, strong, rather tough, close-grained, durable in contact with the soil, and inclined to check in drying; dark brown in color; the sapwood lighter. It is largely used for fencing, railroad ties, and fuel. The bark is rich in tannin.

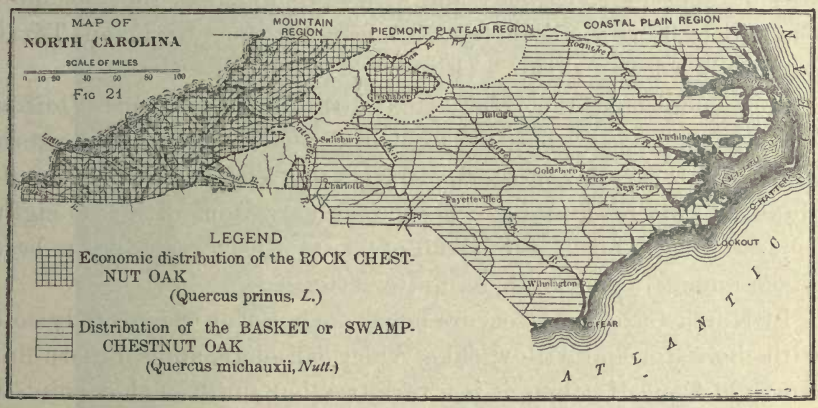
A large amount of bark is peeled in Buncombe, Burke, McDowell, and Wilkes counties to supply local tanneries, and much timber has been cut in Lincoln county for charcoal. Large quantities of chestnut oak still remain, however, in all the western counties.

Quercus michauxii, Nuttall.

(BASKET OAK. COW OAK. SWAMP WHITE OAK. SWAMP CHESTNUT OAK.)

A large tree, of great economic value, with gray rather scaly bark and stout branches, reaching a height of 120 and a diameter of 7 feet.

It occurs from Delaware, south through the lower and middle districts to northern Florida, thence through the Gulf states to the valley of the Trinity river, Texas, and through Arkansas to southeastern Missouri, to central Tennessee and Kentucky, and the valley of the lower Wabash river; reaching its best development on the rich bottom lands in southeastern Arkansas and Louisiana. It is common in the Gulf states.



In this State (fig. 21.) it is found in swamps of the coastal plain and Piedmont plateau regions, and on the bottom lands of the Cape Fear and Neuse rivers, attains a height of 100 and a diameter of 6 feet.

Abundant production of seed occurs at intervals of 2 to 3 years. Seedlings are common in wet open spots on damp hill sides in the

Piedmont plateau region. Sprouts grow readily from the stump, but seldom reach a large size.

The leaves are rather rigid, downy beneath, and with large regular, rounded teeth. The large sweet edible acorns are set in shallow cups which are roughened with acute coarse scales. The brown winter-buds are large, smooth, and pointed. There are many deep lateral roots.

The wood is heavy, hard, very strong, tough, close-grained, compact, easily split, and very durable in contact with the soil; light brown in color; the sapwood darker. It is used for agricultural implements, cooperage, wheel stock, baskets, fencing, fuel, and construction. In the eastern counties a small quantity of the timber has been cut for local uses.

Quercus virginiana, Miller.*

(LIVE OAK.)

A large evergreen tree, with dark, deeply furrowed bark and gray branches, a short body and a flat or spreading top, reaching a height of 60 and a diameter of 7 feet; in the interior of Texas often reduced to a shrub. (Plate VIII.)

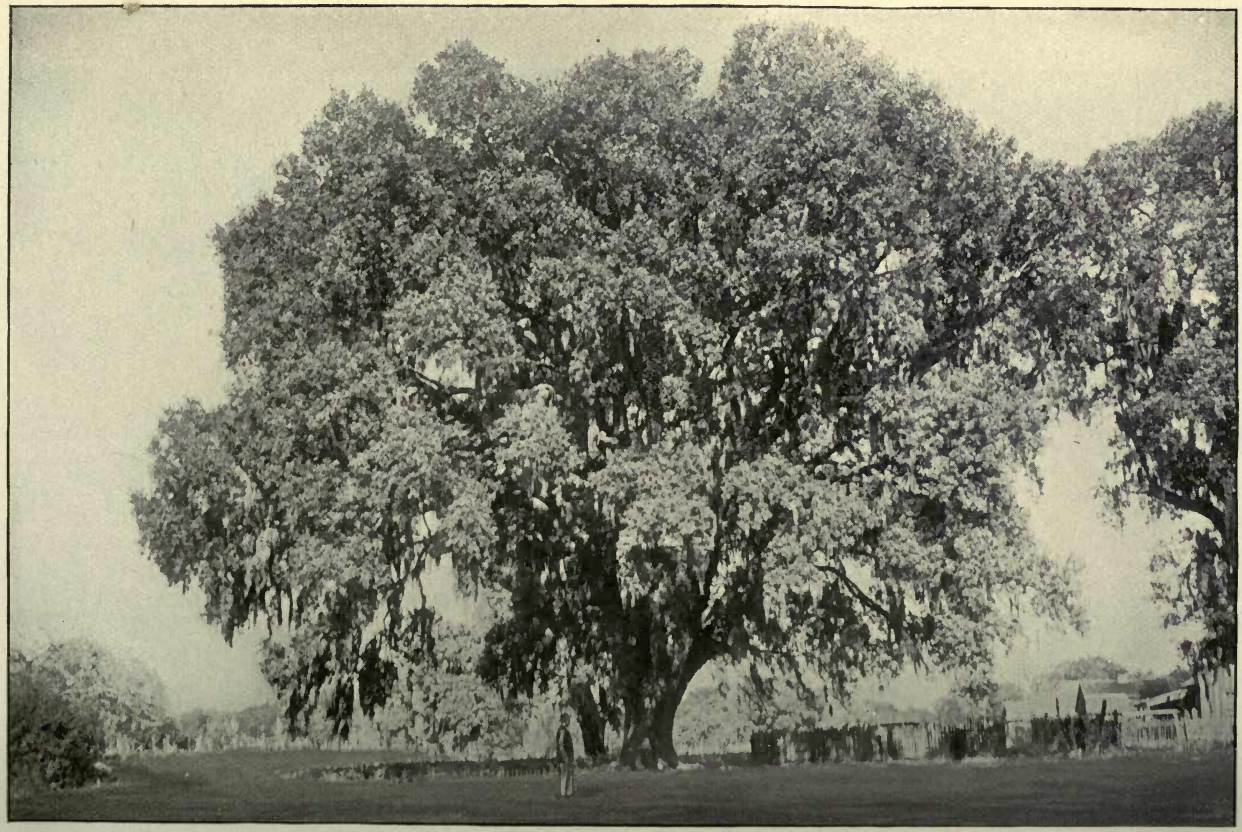
It is found near the coast from Virginia to southern Florida and along the Gulf coast to Mexico, extending through western Texas and the valley of the Red river, the Apache and the Gaudalupe mountains, and into Mexico, at elevations of six to eight thousand feet, and in the island of Costa Rica; reaching its best development in the south Atlantic states.

In North Carolina it occurs near the coast on deep sandy soil with the water and willow oaks, American olive, and southern lin. North of Cape Hatteras it is a rare tree but south of that point it becomes more abundant until, at the mouth of the Cape Fear river, it forms with the palmetto a considerable part of the maritime forest of Smith's island. (Fig. 22, p. 97.)

The growth, particularly in youth, is very vigorous. Young seedlings are common near old trees. Small trees sprout readily from the stump.

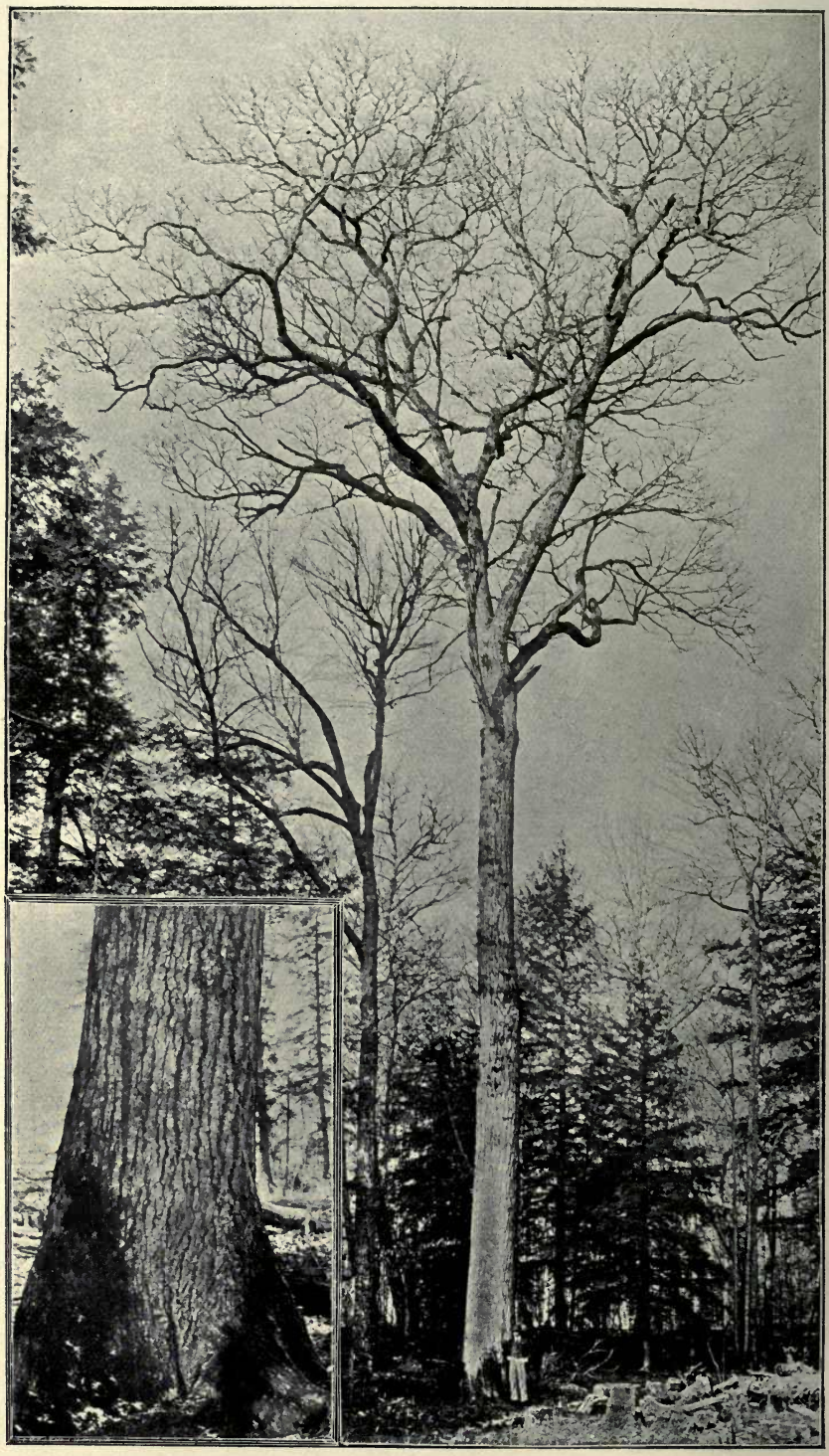
The evergreen leaves are thick, leathery, oblong and obtuse,

*Quercus virens, Aiton.



LIVE OAK ORTON PLANTATION

GROWN IN OPEN FIELD LONG MOSS (TILLANDSIA) HANGING FROM THE LIMBS



RED OAK

smooth above, and hairy beneath. The fruit, which is borne upon a long stem, is an oblong, dark brown, or black acorn set in a top-shaped, downy cup. The roots are spreading and rather deeply seated, and can bear sea water, at least if covered only during high tide.

The wood is very heavy, hard, strong, tough, close grained, compact; it takes a beautiful polish, but is difficult to work; light brown or yellow in color; the sapwood nearly white. It is used for shipbuilding, and the bark is occasionally employed for tanning. It is not abundant enough in North Carolina to be of commercial importance.

Quercus rubra, Linnæus.

(RED OAK.)

A large tree, with dark brown furrowed bark, nearly black on large trunks, and rather smooth branches which form a large oval or round head, reaching a height of 150 and a diameter of 7 feet. (Plate IX.)

It occurs from Nova Scotia, southern New Brunswick, and eastern Minnesota, western Iowa, eastern Kansas and Indian Territory south to northern Florida, southern Alabama and Mississippi, and western Texas, reaching its best development north of the Ohio river. A common tree.

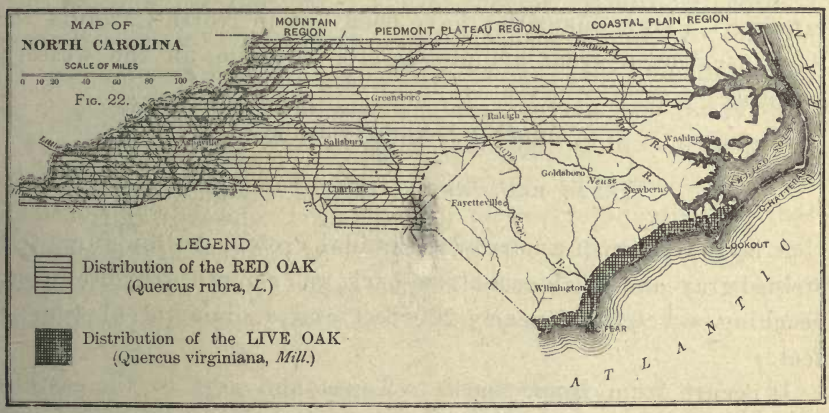


FIG. 22.

In the coastal plain region of North Carolina it is rare; somewhat more common in the Piedmont plateau on shady hillsides and

moist land; and most abundant in the mountains where it is frequently 130 feet high and 6 or 7 feet in diameter. (Fig. 22.) At high elevations it is often found with the chestnut oak on dry ridges, and there attains an average height of 60 to 70 feet. In the Piedmont plateau it is often confounded with the black oak.

It bears acorns plentifully about every second year, though two seed years in succession are not unusual. Young seedlings are common in the woods and endure heavy shade well, but need a light cover for rapid growth. Young trees are very sensitive to fire. Only small specimens sprout well from the stump. After lumbering the regrowth usually consists of the same species mixed with chestnut oak, scarlet oak, white oak, and chestnut.

The thin, glossy leaves are oblong, wedge-shaped at the base, and usually dilated toward the end, with 5 or 6 lobes on each side separated by rounded, rather shallow notches. The thick, oblong, broad-based acorn is dark brown and seated in a shallow small-scaled cup which is either short-stalked or sessile. The ovate pointed winter-buds are dark brown and smooth. The tap-root develops early in life, and after the plant is well started a system of large lateral roots is formed.

The wood is heavy, hard, strong, coarse-grained, and inclined to check; light brown or red in color; the sapwood somewhat darker. It is used for clapboards, cooperage, interior finish, and the manufacture of furniture. The bark is occasionally used for tanning. Large quantities have been cut in North Carolina for local use, but a great amount is still standing in the western counties.

Quercus texana, Buckley.

(TEXAS RED OAK. SWAMP RED OAK.)

A large tree, with a narrow pyramidal crown, shallow-furrowed striped gray and black or mottled bark, and smooth gray branches, reaching a height of nearly 200 feet and a diameter of 4 to 8 feet.

It occurs from Iowa south to Texas and east to the eastern part of Virginia and central Georgia; reaching its greatest development on the alluvial lands of the lower Mississippi river. It grows to a greater height than any other American oak.

In North Carolina, where it attains an average height of 50 to 70 feet, it is locally found from Lincoln county eastward to Person county, growing on the rich, moist loams of river swamps or on

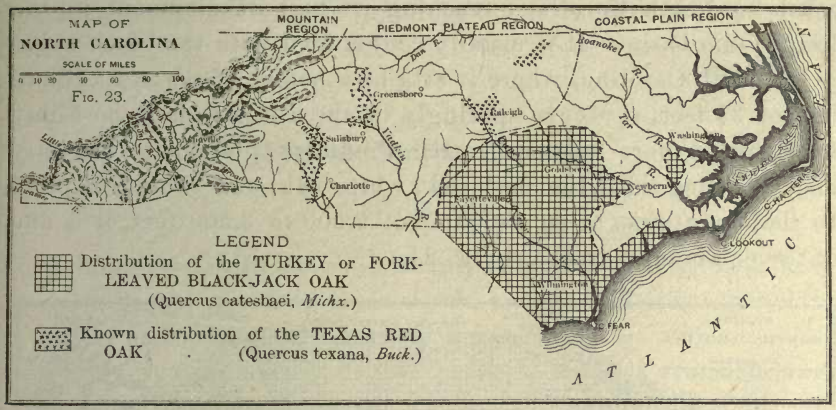


Fig. 23.

LEGEND

Distribution of the TURKEY or FORK-LEAVED BLACK-JACK OAK (Quercus catesbaei, *Michx.*)

Known distribution of the TEXAS RED OAK (Quercus texana, *Buck.*)

damp hillsides, associated with the yellow oak, swamp white oak, red and willow oaks, and elms. (Fig. 23.)

Throughout North Carolina it reproduces itself slowly, and young seedlings are rarely found in the forest, although it flowers regularly and matures fruit every two or three years.

The small thin light green leaves, deeply lobed on the sides, are smooth on both surfaces, except for large tufts of brownish hairs beneath in the axils of the primary veins. The leaf-stem is nearly as long as the leaf. The oblong or cylindrous acorn is borne in a shallow cup, which like the acorn, is generally smooth. The long acute sharply angled winter-buds are smooth, as are the steel-gray twigs. The strong lateral roots lie near the surface.

The wood, heavier and stronger than that of the northern red oak, is coarse-grained and porous, reddish-brown in color; the thick sapwood light brown. It is superior in working qualities to that of the northern red oak or any other of the American red and black oaks. In North Carolina, on account of the infrequent occurrence of the tree, the wood is put to no specific uses.

Quercus coccinea, Muenchhausen.

(SCARLET OAK. SPOTTED OAK. SPANISH OAK. RED OAK).

A slender tree, with a short trunk, smooth dark gray or black

finely ridged bark, and smooth gray branches which form an oval top, reaching a height of 175 and a diameter of 4 feet.

It occurs from Maine to Ontario, Minnesota, and Nebraska, and south to North Carolina; reaching its best development in the lower Ohio basin. It is usually confounded with the black oak.

In North Carolina, where it attains a height of 80 and a diameter of 3½ feet, it occurs sparingly in the coastal plain on sandy loam, but is more common in the Piedmont plateau on gravelly loam growing with the post oak, white oak, and short-leaf pine. In the mountains, at an elevation of 2,500 to 3,500 feet, it is one of the commonest trees. (Fig. 24.)

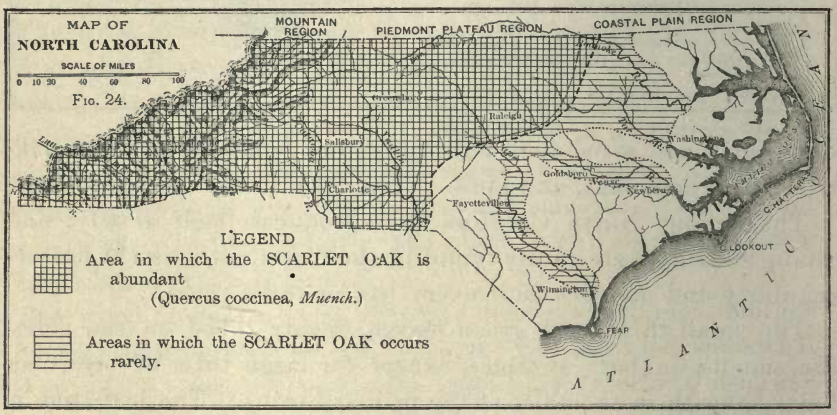


FIG. 24.

The scarlet oak bears acorns plentifully every 2 or 3 years, and young plants are common through the woods in many of the western counties. Only young trees sprout readily from the stump. Trees over 3 feet in diameter are usually hollow or red-hearted, dry rot causing the defect.

The thin smooth leaves are on long slender stems and deeply cut into long lobes by broad round notches. They turn to a brilliant scarlet in the autumn. The small oval acorns are strongly pointed and half-imbedded in a deep coarsely-scaled cup. The slender, slightly angled winter-buds are pointed, and, like the slender twigs, smooth and reddish. The root system of older trees is distinctly lateral, many of the roots being superficial, or frequently exposed.

The wood is heavy, hard, strong, and close-grained; the heartwood light brown or red; the sapwood rather darker. The lumber, if used at all, is confounded with that of the red oak. The bark is sometimes used in tanning, but is inferior to that of the black oak. It is rarely used in this State except for coarse staves and shakes, and for fuel.

Quercus velutina, Lamarck.*

(BLACK OAK.)

A large tree, with rough or deeply furrowed nearly black bark, grayish branches, a long clear trunk, and an oval crown, reaching a height of 160 and a diameter of 6 feet.

It is very common on dry or gravelly uplands from Maine to Minnesota, eastern Nebraska, Kansas, and Indian Territory, and south to western Florida, and eastern Texas. It reaches its best development in the valley of the lower Ohio river.

In North Carolina (fig. 25), where it attains an average height of 80 to 90 and an average diameter of 4 to 5 feet, it is most abundant in the upper part, and occurs very sparingly, if at all, in the lower.

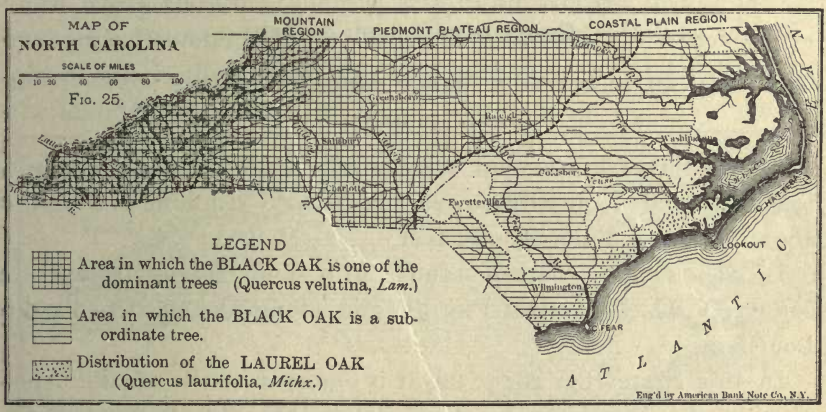


FIG. 25.

It bears fruit abundantly at intervals of 2 or 3 years, and seedlings are common under the light shade of the parent tree. Black oak forms a large part of the second growth mixed hard-

*Quercus tinctoria, Bartram.

wood forests in the middle and the lower part of the Piedmont plateau. Large trees are often hollow or red-hearted.

The forest tent caterpillar, Clisiocampa disstria, Huebner, is often destructive to the foliage, and much injury is also caused, especially to young trees, by the oak pruner, Elaphidion villosum, Fabricius.

The leaves are inversely egg-shaped, thicker and less deeply cut than those of the scarlet oak, and usually darker in color and less polished. The small acorn, nearly half enclosed in a thick scaly cup, contains a yellowish and very bitter kernel.

The buds are thick, pyramidal, and downy. There are many deeply penetrating lateral as well as superficial running roots.

The wood is heavy, hard, strong, not tough, coarse-grained, liable to check in drying; bright brown tinged with red in color; the sapwood much lighter. It is used for cooperage, construction, etc. The bark is largely used for tanning. Quercitron, a valuable yellow dye, is derived from the inner bark, which has astringent medicinal properties.

It has been cut extensively throughout the Piedmont plateau for building material and cooperage, and locally the bark has been employed to a considerable extent in tanning.

Quercus catesbæi, Michaux.

(FORK-LEAVED BLACK-JACK OAK. SAND BLACK-JACK OAK. SCRUB OAK. TURKEY OAK.)

A small tree, with oval crown, numerous irregular drooping branches, and deeply furrowed black bark, reaching a height of about 50 and a diameter of 2 feet.

It occurs upon barren sandy hills and ridges from Gates county, N. C., to central Florida, and along the coast to eastern Louisiana.

In this State (fig. 23, p. 99) it is common south of the Neuse river in the pine barrens, where it has a height of about 20 feet and a diameter of 8 inches.

Fork-leaved black-jack oak, generally bears fruit annually, and seedlings are very abundant on dry sandy soil. Its growth is rapid, but in North Carolina the tree seldom lives longer than 40

years. It grows frequently with the long-leaf pine, and often replaces it after lumbering.

The rather leathery, broadly oval leaves are deeply lobed. The large ovoid acorn is half enclosed in a short-stalked, thick, top-shaped cup. The winter buds are large, conical and covered with brownish down. The root system consists of deep lateral roots.

The wood is heavy, hard, strong, close-grained, compact, and light brown in color; the sapwood somewhat lighter. It is largely used for fuel. The ash is rich in alkali and the bark in tannin.

Quercus digitata, Sudworth.*

(SPANISH OAK. RED OAK.)

A tree, with a large spreading top, nearly black rough bark, and smooth dark gray branches, reaching a height of 100 and a diameter of 6 feet.

It occurs from southern New Jersey south to middle Florida, through the Gulf states to the Brazos river, Texas, and through Arkansas and southeastern Missouri to central Tennessee and Kentucky, southern Illinois and Indiana; reaching its best development in the South Atlantic and Gulf states.

In North Carolina where it attains an average height of 70 to 80 and a diameter of 3 to 4 feet, growing on dry heavy soils, it is very common throughout, (fig. 26,) although rather less so toward the mountains.

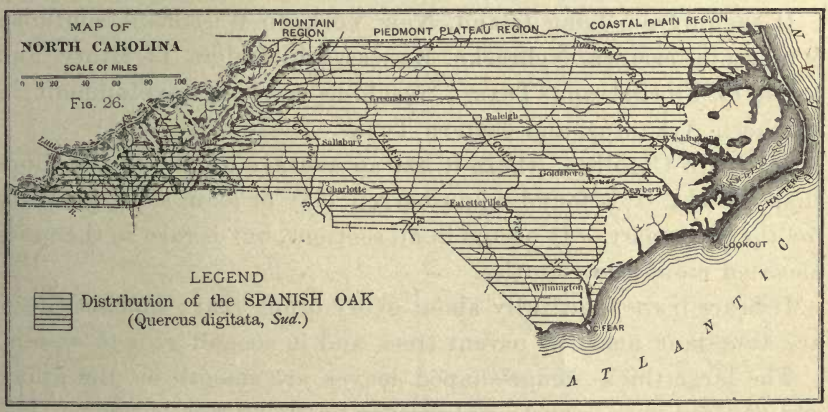


Fig. 26.

Acorns are borne in abundance every 3 or 4 years, and young

* Quercus cuneata, Wangenheim and Q. falcata Michaux.

seedlings are plentiful in rather dry open woods. On the dry, rocky uplands of the counties in the middle part of the State, a considerable part of the second growth is composed of this species. Trees over 3 feet in diameter are generally not sound at the heart. Coppice shoots are very abundant around the stumps of smaller trees. This tree is sensitive to late frosts.

The leaves are divided into 3 to 5 prolonged, mostly narrow, bristle-tipped lobes, and are downy on the lower surface. The short-stemmed fruit consists of a small globose acorn half enclosed in a somewhat top-shaped cup. The light brown winter-buds are covered with a light reddish down. The Spanish oak has, in addition to many deeply penetrating lateral roots, numerous long superficial running roots.

The wood is heavy, very hard, strong, not durable, coarse-grained, and checks badly in drying; light red in color; the sap-wood lighter. It is used for cooperage, construction, and very largely for fuel. The bark is rich in tannin. A large amount of Spanish oak timber is still standing in the Piedmont plateau region, where it is one of the most common trees.

Quercus marilandica, Muenchhausen.*

(BLACK-JACK OAK.)

A small tree, with rough black bark, and drooping irregular branches, reaching a height of 60 and a diameter of 2 feet.

It occurs from Long Island, New York, to Wisconsin, southern Minnesota, eastern Nebraska, Kansas, and Indian Territory, and south to Florida and Texas; reaching its best development in southern Arkansas, and eastern Texas.

In North Carolina, where it has an average height of not more than 25 feet, it is found upon barren clay or loam soils, gravelly for the most part. It occurs in all sections, but is rare in the more elevated mountain counties.

It bears fruit plentifully about every other year; and seedlings are abundant near the parent trees and in second growth woods.

The large thick wedge-shaped leaves are smooth on the upper and covered with a rusty pubescence on the lower surface. The

*Quercus nigra, Linnæus.

WATER OAK

small globular acorn is half enclosed in a top-shaped, coarse-scaled cup. The conical, bright brown winter-buds are covered, like the angular twigs, with a light gray down. The buds are frequently injured by late frosts. The black-jack oak has a lateral root system.

The wood is heavy, hard, and strong, and checks badly in drying; dark red-brown in color; the sapwood much lighter. It is little used except for fuel.

Quercus nigra, Linnæus.*

(WATER OAK.)

A small tree, with a large spreading top, dark rough bark at the base of the stem and smoother gray bark above, reaching a height of 80 and a diameter of 4 feet. (Plate X.)

It occurs from Delaware through the coast and middle districts to Florida and Texas, and westward to Missouri and Indian Territory; reaching its best development in the maritime pine belt of the eastern Gulf states. A common tree.

In this State, where it reaches an average height of 40 to 50 feet and an average diameter of 12 to 20 inches, it is abundant on moist soil, usually bordering swamps and streams, in the coastal plain region and some parts of the Piedmont plateau region. (Fig. 27.)

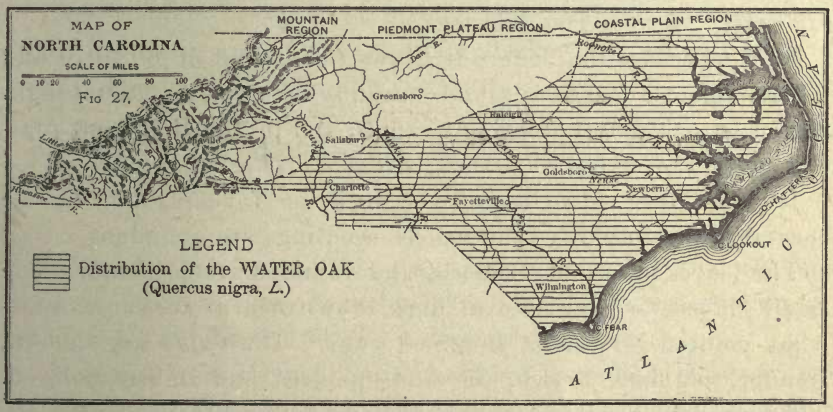


FIG 27.

It is one of the commonest trees on the oak flats about the swamps of the coastal plain.

*Quercus aquatica, Walter.

The larger, crown-forming limbs are often broken, and the stem is very frequently hollow or red-hearted. The trunk is apt to be covered with adventitious shoots. Even large trees send up numerous sprouts from the stump. The growth is generally rapid.

The leaves are generally deciduous, although, on the coast, many remain green during the winter, especially on vigorous shoots. They are thick, smooth, narrowed at the base, and rounded, or 3-lobed and bristle-tipped at the extremity. The small globular-ovoid acorn is set in a very shallow cup. The winter-buds are small and conical, upon slender flexible polished brown twigs. The lateral superficial roots are large and well developed.

The wood is heavy, hard, strong, coarse-grained, and compact; rather light brown in color; the sapwood lighter. It is used only as fuel.

Quercus laurifolia, Michaux.

(LAUREL OAK. WATER OAK. WILLOW OAK. PIN OAK. TURKEY OAK.)

A tree, with dark brown minutely roughened bark, and smoother and lighter branches which form an oval crown, reaching a height of 100 and a diameter of 4 feet.

It occurs from North Carolina southward near the coast to Mosquito Inlet and Cape Romano, Florida, and along the Gulf coast to Mobile bay; reaching its best development on the Florida coast. A very common tree.

In North Carolina, where it grows to a height of 60 to 70 and a diameter of 3 feet, it is found on sandy loam in the coastal plain region on oak flats bordering swamps, and in the Piedmont plateau usually on damp soils along streams. (Fig. 25, p. 101.)

It bears fruit plentifully once in 3 or 4 years, and in the coastal plain, in moist open woods, seedlings are abundant.

The leaves are thick, smooth, and rounded at each end. The small globose or slightly oval dark brown acorns are set in somewhat pointed very short stemmed cups. The twigs are smooth, slender, and dark brown, the buds pointed and lighter colored. The numerous lateral roots generally do not penetrate very deeply into the soil.

The wood is heavy, very strong, hard, coarse-grained, and inclined to check in drying; dark brown in color; the sapwood lighter. It is sometimes, although rarely, used for clapboards and coarse staves.

Quercus brevifolia, Sargent.*

(UPLAND WILLOW OAK. TURKEY OAK. BLUE JACK.)

A small tree, with large oval crown, rough dark gray bark, and slender drooping branches, reaching a height of 50 feet and a diameter of 18 to 20 inches.

It occurs on sandy barrens and dry ridges from North Carolina near the coast to Cape Malabar and Pease creek, Florida, and westward along the Gulf coast to eastern Texas.

In this State, where it has an average height of 30 feet and a diameter of 10 inches, it is found in the pine barrens of the coastal plain region. Immediately along the coast it sometimes reaches a larger size.

It bears fruit abundantly and at frequent intervals, and seedlings and young trees are common on the dry pine barrens.

The oblong entire leaves are bristle-tipped and covered with a white down on the lower surface. About one-third of the small globose hoary acorn is covered by a stemless shallow cup. The winter-buds are small and oval.

The wood is heavy, hard, strong, close-grained, and compact; light brown in color; the sapwood darker. It is used only for fuel. The bark yields a fine yellow dye.

Quercus imbricaria, Michaux.

(SHINGLE OAK.)

A slender tree, with dark gray, rough or rather smooth bark, and smooth, light gray branches which form a large spreading top, reaching a height of 100 and a diameter of 4 feet.

It occurs from Pennsylvania westward to western Missouri and northeastern Kansas, and south to northern Georgia and Alabama,

*Quercus cinerea, Michaux.

middle Tennessee, and northern Arkansas; reaching its best development in the basin of the Ohio river.

In this State, where it attains an average height of 40 to 50 feet and an average diameter of 12 to 15 inches, it is confined to the mountains and western part of the Piedmont plateau, where it is usually found along streams on alluvial loams. (Fig. 28.)

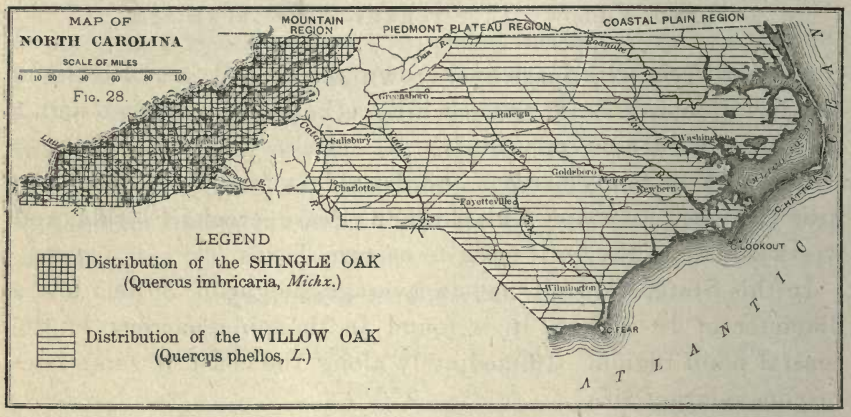


FIG. 28.

Seed years are frequent and young seedlings are common, near the parent tree, on moist valley lands in the mountains.

The oblong lance-shaped leaves are entire, pale downy below, and tipped with an abrupt sharp point. The acorn is nearly globular and about one-third to one-half enclosed by a cup which is covered with broad whitish closely appressed scales. The brown winter-buds are acute and small-scaled.

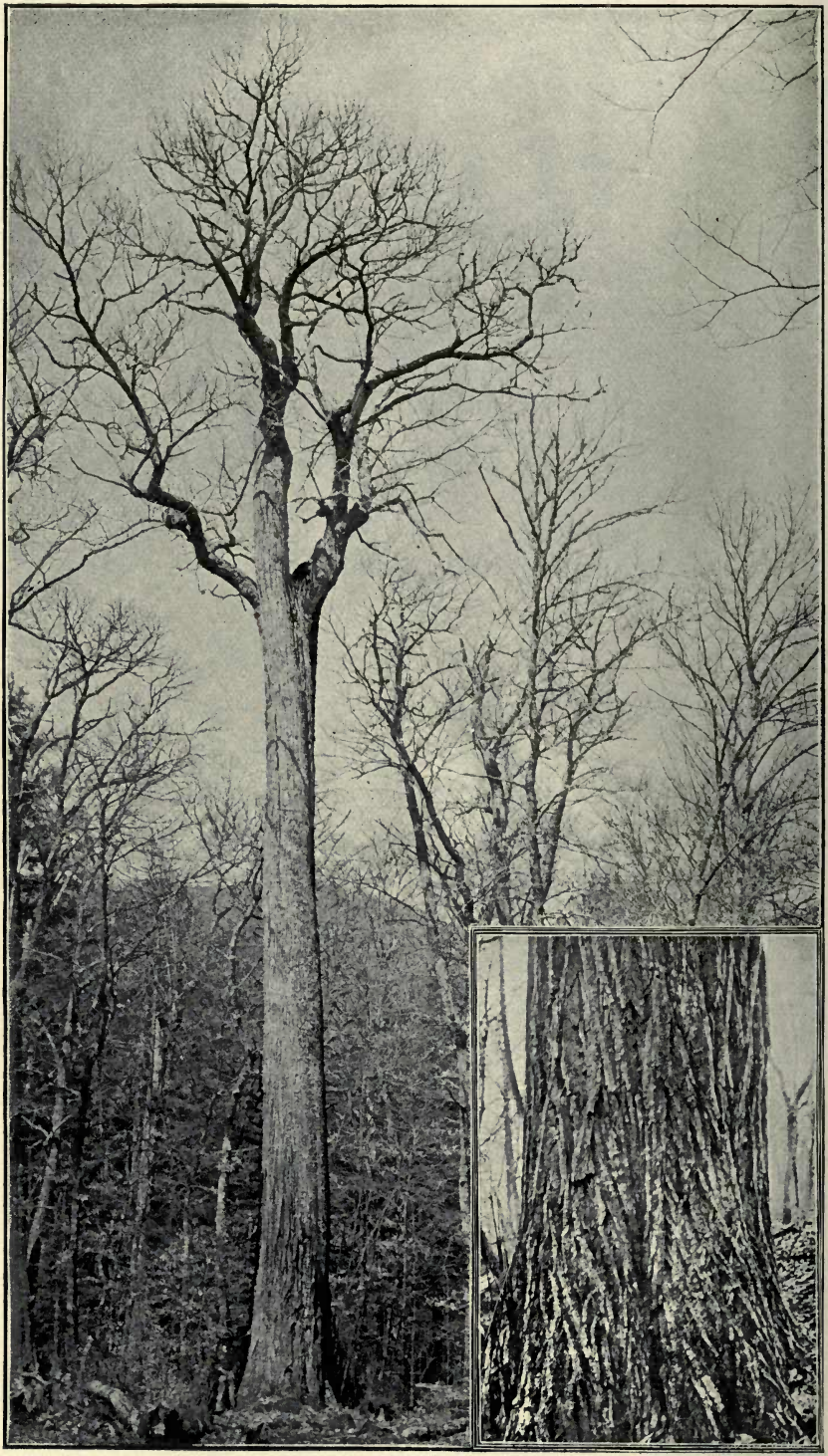
The wood is heavy, hard, rather coarse-grained, and checks badly in drying; light brown in color; the sapwood much lighter. It is occasionally used for clapboards and shingles, and in construction.

Quercus phellos, Linnæus.

(WILLOW OAK.)

A tree, with large spreading crown, rough dark brown bark, and smooth branches, reaching a height of 80 and a diameter of 4 feet.

It occurs from Staten Island, New York, south near the coast to



CHESTNUT

northeastern Florida, through the Gulf states to eastern Texas, and through Arkansas to southeastern Missouri, Tennessee, and southern Kentucky.

In this State, where it reaches an average height of 50 to 60 and an average diameter of 2 feet, it occurs in large numbers in the coastal plain region and, scatteringly, in the Piedmont plateau region, in moist situations. (Fig. 28, p. 108).

The willow oak forms a considerable portion of the second growth hardwood forests on the moist sandy loams of the coastal plain region and young trees are common along the streams of the Piedmont plateau. Young trees sprout vigorously from the stump.

The leaves are narrow, lance-shaped, pointed at each end, thick, entire or nearly so, and downy when young. The acorns are small, globose, and set in a shallow flattened cup. The buds are small, pointed, smooth, and light brown; the twigs slender. The willow oak has numerous spreading lateral roots.

The wood is heavy, strong, not hard, rather close-grained, compact; light brown in color tinged with red; the sapwood a lighter red. It it somewhat used for the felloes of wheels, clapboards, and in construction.

Castanea dentata, Borkhausen.

(CHESTNUT.)

A very common large and valuable tree, with deeply furrowed dark gray bark, and smooth light gray branches which form a large spreading crown, reaching a height of 120 and a diameter of 13 feet. (Plate XI.)

It occurs from southern Maine, southern Ontario, and southern Michigan, southward to Delaware and middle Tennessee, and along the Appalachian mountains to northern Alabama, reaching its best development on the western slopes of the southern Alleghanies.

In North Carolina, where it is confined to the mountain region (fig. 29), it reaches an average height of 50 to 70 and an average diameter of 5 feet, but in favorable locations it sometimes attains the largest dimensions given above.

Abundant production of seed occurs about every other year. Young plants are plentiful in moderately open woods and in old fields. The young trees are decidedly light-demanding and die

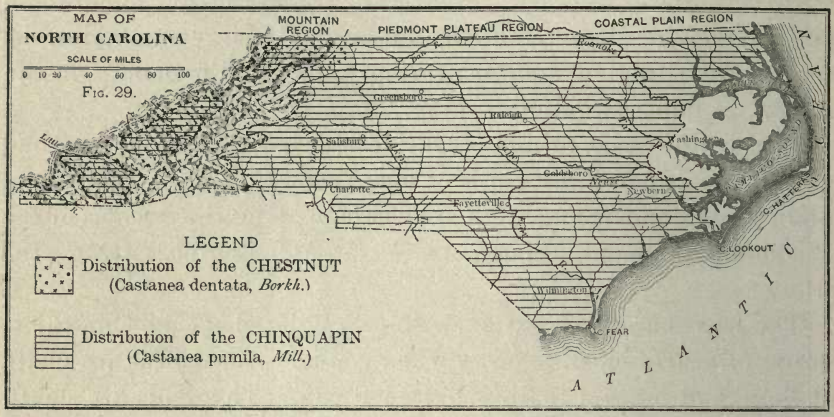


FIG. 29.

quickly in deep shade. Specimens over 5 feet in diameter are generally unsound. After lumbering a growth of the same species, together with oaks, (generally the white, scarlet and black oak) springs up. The chestnut enters largely into the composition of most second growth hardwood forests in the extreme western counties. It sprouts very freely from the stump and the shoots often grow to be large trees. The stumps retain their power of sprouting for many years. The trunk is sometimes attacked by the chestnut borer, Arliopalus fulminans, Fabricius, and the nuts by the chestnut weevil, Balaninus caryatrypes, Boheman.

The thin oblong leaves are straight-veined and serrate with coarse sharp teeth. The yellowish-green sterile flowers are in large spreading bunches of catkins, appearing in the middle of the summer; the fertile flowers are inconspicuous. The fruit consists of 2 or 3 flattened dark brown shining edible nuts enclosed in a light brown prickly bur. The winter-buds are small and ovate. A tap-root is early developed. Later, strong deeply seated lateral roots are formed.

The wood is light, soft, not strong, coarse-grained, easily split, very durable in contact with the soil, and liable to check and warp in drying; brown in color; the sapwood lighter. It is used for cabinet-making, interior finish, railway ties, fencing, and

posts, and is well adapted for charcoal. An extract from the leaves is used medicinally.

The chestnut is very common in the mountain counties of North Carolina at an elevation of 2,500 to 4,500 feet, and is sawed extensively for local uses.

Fagus ferruginea, Aiton.

(BEECH.)

A tree, with round or oval crown, smooth light gray bark, and delicate branchlets, reaching a height of 110 and a diameter of 4 feet.

It occurs from Nova Scotia and northern Wisconsin, south to western Florida and eastern Texas; reaching its best development on the bluff formations of the lower Mississippi basin.

In this State, where it attains an average height of 50 to 80 and an average diameter of 2 to 3 feet, it is found sparingly and of small size in the coastal plain region, more commonly and of larger growth in the Piedmont plateau, and most abundantly and of greatest size in the mountain region.

The beech bears seed plentifully every 4 or 5 years, or along streams or in sheltered hollows more frequently. Young seedlings are common in damp shady woods, especially above 3,000 feet elevation. Towards the summits of many high mountains it forms, with birch and sugar maple, nearly the entire growth. The young trees are capable of enduring deep shade.

The leaves are thin, smooth, and straight-veined, each vein ending in a large tooth. The sterile flowers occur in small heads upon drooping silky stems, and the fertile flowers are often in pairs on the summit of short stalks. The fruit consists of a prickly bur, enclosing two triangular sharp-ridged edible nuts. The brown winter-buds are long, slender, and pointed; the twigs small and smooth. The root system consists of long superficial roots which are frequently exposed.

The wood is very hard, strong, tough, very close-grained, not durable in contact with the soil, and inclined to check in drying;

dark or lighter red in color; the sapwood nearly white. It takes a beautiful polish, and is used for chairs, shoe-lasts, plane-stocks, handles, and for fuel. The bark is sometimes used for tanning, and a valuable oil is derived from the nuts. The wood is little used in North Carolina except for fuel.

Ostrya virginica, Willdenow.

(HOP HORNBEAM. IRONWOOD.)

A small tree, with smooth dark brown branches, brownish finely furrowed bark, and an oval head, reaching a height of 50 and a diameter of 2 feet.

It occurs from the Bay of Chaleur to northern Minnesota, south to eastern Texas, and along the Appalachian mountains and Piedmont region to western Florida; reaching its best development in southern Arkansas.

In North Carolina, where its average height is 20 to 30 feet, it occurs only in the Piedmont plateau and mountain regions. In rich spots near the summits of some of the high mountains, at an elevation of 4,500 to 5,200 feet, it forms small patches of almost pure forest or grows in mixture with the sugar maple and service tree.

The hop hornbeam bears seed at frequent intervals. Small trees sprout freely from the stump. Numerous adventitious branches grow from the trunks of older trees. It is a slow growing tree and can endure deep shade even in youth. Trees over 12 inches in diameter are very often hollow.

The thin leaves are oblong-ovate or elliptical, finely pointed, sharply toothed, smooth above and somewhat hairy beneath. The male flowers occur in drooping cylindrical catkins, the female in short and slender ones. The fruit is hop-like and is made up of from 12 to 20 seed vessels each containing one hard pointed nutlet. The prominent winter-buds are dark brown and cone-shaped. The hop hornbeam has a tap-root and deeply penetrating lateral roots.

The wood is heavy, very strong, hard, tough, very close-grained, compact, light brown in color, or often nearly white, like the

sapwood. It is used for posts, levers, mill cogs, wedges, mallets, and the handles of tools.

Carpinus caroliniana, Walter.

(HORNBEAM. IRON WOOD. BLUE BEECH. WATER BEECH.)

A small tree, with a short smooth dark bluish-gray or slate-colored trunk, marked by irregular longitudinal ridges, smooth gray branches, and a round or flat spreading crown, reaching a height of 50 and a diameter of 3 feet.

It occurs from Nova Scotia to northern Minnesota, southward to central Florida, and through Iowa, Kansas, and Indian Territory to eastern Texas; reaching its best development on the western slopes of the southern Appalachian mountains, and in southern Arkansas, and in eastern Texas.

In North Carolina, where it grows to a height of 25 feet and a diameter of 14 inches, it is found along water-courses throughout the State.

It bears seed, at least in the Piedmont plateau, very frequently, and young growth is common along streams where the trees stand thinly. The best growth takes place under moderate cover, though the tree adapts itself to a wide range of light and shade.

The leaves are oblong or elliptical, rounded at the base, sharply toothed, and slightly hairy on the veins beneath. The male flowers are in drooping cylindrical catkins. The fertile spikes are terminal, long-stemmed, and 6 to 12 flowered. The angular nuts are solitary and at the base of a 3-lobed leaf-like scale. The winter-buds are small and acute; the twigs slender. The roots are superficial.

The wood is heavy, very strong, close-grained, and inclined to check in drying; light brown in color; the thick sapwood nearly white. It is used for levers, the handles of tools, etc.

Betula lutea, F. A. Michaux.

(YELLOW BIRCH. BITTER BIRCH.)

A tree, with spreading branches, and silvery yellow bark which scales off in thin sheets, reaching a height of 95 and a diameter of 4 feet.

It is common from Newfoundland to the western shores of Lake Superior and Rainy Lake, south through the northern states to Delaware, and southern Minnesota, and along the Appalachian mountains to the high peaks of North Carolina and Tennessee; reaching its best development in southern Canada and the north-eastern United States.

In this State, where it attains a height of 80 to 90 and a diameter of 2 to 3 feet it is confined to the high mountains, where, in damp woods, it is not uncommon. (Fig. 30, p. 115.)

Seed is produced abundantly every 2 or 3 years, and young trees are common in damp shady woods at high elevations. It grows rapidly when the light conditions are favorable. Specimens over three feet in diameter are usually hollow.

The leaves are elliptical or ovate, coarsely toothed, and hairy on the midrib beneath. The male catkins are cylindrical and pendulous; the female short and nearly erect, which, when mature, form an egg-shaped cone, 1¼ inches long, made up of stiff tough 3-lobed scales and containing winged seeds. The flowers appear in early spring before the leaves. The prominent winter-buds are smooth and conical. The undeveloped male catkins are formed in the fall and are conspicuous during the winter. The yellow birch has a tap-root, which usually forks and takes a lateral direction, and several strong lateral roots.

The wood is heavy, very strong, hard, very close-grained, compact; light brown in color; the heavier sapwood nearly white. It takes a beautiful polish, and is used for furniture, veneering, button and tassel-moulds, spools, pill and match boxes, the hubs of wheels, flooring, and fuel.

Betula nigra, Linnæus.

(RIVER BIRCH. RED BIRCH. BLACK BIRCH.)

A tree, with a short trunk, a large, spreading top, reddish-brown furrowed bark on the stem, and on the branches reddish-white bark which separates in thin papery layers, reaching a height of 80 and a diameter of 3 feet.

It occurs in moist situations from Massachusetts southward through the coast and middle districts to western Florida, and

westward to western Iowa and eastern Texas; reaching its best development in the south Atlantic states and the basin of the lower Mississippi river.

In this State, where it reaches an average height of 40 to 60 and an average diameter of 1 to 2 feet, it is found along streams and on the borders of swamps from the coast to the mountains. (Fig. 30.)

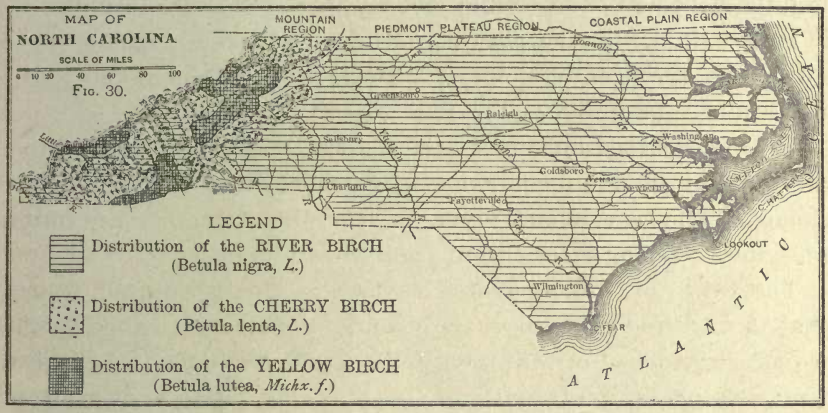


Fig. 30.

It bears seed at frequent intervals, and young growth is common on alluvial soil near the edges of fields and along streams. Young trees when cut send up numerous sprouts.

The leaves are acute at each end, doubly-toothed, bright green above, and glaucous beneath when young. The fruit is an oblong spike (with woolly, 3-lobed bracts), containing the small rather broadly-winged seeds. The river birch matures its seed early in summer. The winter-buds are oval and dark brown; the twigs brown, and downy when young. The root system consists of deeply penetrating lateral and running roots.

The wood is light, rather hard, strong, close-grained and compact; brown in color; the sapwood much lighter. It is used for furniture, woodenware, wooden shoes, ox yokes, etc., and cask hoops of inferior quality are made from the branches.

Betula lenta, Linnæus.

(CHERRY BIRCH. BLACK BIRCH.)

A tree, with reddish-brown rough bark on old trees, smooth

dark bark which resembles that of the cherry on the branches and on young trees, and a large oval crown, reaching a height of 80 and a diameter of 5 feet. (Plate XII.)

It occurs from Newfoundland and the valley of the Saguenay river westward through Ontario to the islands of Lake Huron, southward to northern Delaware and southern Indiana, and along the Alleghany mountains to western Florida, and westward to middle Kentucky, and Tennessee.

In North Carolina, where it reaches an average height of 60 to 80 and an average diameter of 2 to 2½ feet, it is confined to the mountains. (Fig. 30, p. 115.)

It produces seed once in 3 or 4 years. Young seedlings, which are common in damp cool woods, are short lived if very heavily shaded. Old specimens, over 2 feet in diameter, are often unsound. Young trees sprout from the stump.

The ovate or oblong-ovate leaves are finely pointed, heart-shaped at the base, and sharply and irregularly toothed. The fruit is cylindrical or elliptical, with rounded ends, 1 to 1¼ inches long, and made up of small closely set scales. The buds are conical and pointed. The cherry birch has a superficial root system, although in young growth there is a prominent tap-root.

The wood is heavy, very strong and hard, close-grained, compact; dark brown in color; the sapwood light brown or yellow. It takes a beautiful polish, and is used for furniture and fuel, and in Nova Scotia and New Brunswick for shipbuilding. Birch beer is made from the sap of this species. In some parts of North Carolina considerable quantities of cherry birch have been cut for lumber.

Salix nigra, Marshall.

(WILLOW. BLACK WILLOW. RIVER WILLOW.)

A small tree, with a large oval crown, dark rough bark on the trunk, and smooth light brown bark on the spreading branches, reaching a height of 50 and a diameter of 2 feet, or towards its southeastern limit a mere shrub.

It occurs along streams from New Brunswick and Lake Superior south to Florida and Texas, and in the valleys of the Sacramento river, California, and the Colorado river, Arizona.

CHERRY BIRCH

In North Carolina it is found from the coast to the mountains, growing on loamy soils along streams, and reaches a height of 30 feet and a diameter of 15 inches. It is rare in the high mountains, but in the Piedmont plateau is much more abundant.

Seed is borne abundantly and at frequent intervals, and seedlings are common on bottom lands. Trees of all sizes sprout from the stump. It is easily propagated from cuttings. The smaller branches and twigs are often injured by a saw fly, Cimbex americana.

The leaves are narrow, lance-shaped, toothed and tapering at the ends. The flowers appear in early spring in drooping catkins, the male and female on separate trees. The fruit is a pendulous catkin, made up of small capsules containing minute seeds which are clothed with long silky hairs. The roots are very fibrous and tough. The light, coarse-grained wood is soft, not strong, and brown in color; the sapwood much lighter. The bark is sometimes used medicinally.

Populus grandidenta, Michaux.

(POPLAR. ASPEN. LARGE-TOOTHED ASPEN.)

A tree, with a short body, pyramidal crown, and rather smooth gray bark, reaching a height of 80 and a diameter of 2½ feet.

It occurs in moist situations from Nova Scotia and New Brunswick westward through Ontario to northern Minnesota, south through the northern states, and along the Appalachian mountains to North Carolina, extending westward to middle Kentucky, and Tennessee.

In this State, where it reaches an average height of 40 feet and an average diameter of 12 inches, it is found in the upper part of the Piedmont plateau, but is not very common.

Although it bears seed frequently, young seedlings are uncommon. The rate of growth is uniformly rapid. The trunk is attacked by several borers and the leaves are often stripped off by caterpillars.

The leaves, which are borne on slender flattened stems are roundish, with 5 to 9 large blunt teeth on each side. The flowers

appear before the leaves in spring in drooping cylindrical catkins, the sterile and fertile on separate individuals. The fruit is a catkin consisting of small dry capsules with minute seeds, coated with cottony down. The buds are conical and slightly downy.

The wood is light, soft, not strong, close-grained, and compact; light brown in color; the sapwood nearly white. It is used for wood pulp, and occasionally for turnery and woodenware.

Populus heterophylla, Linnæus.

(COTTONWOOD.)

A rare and local tree, with oval-oblong crown, dark gray bark, and lighter colored branches, reaching a height of 90 and a diameter of 3 feet.

It occurs on the borders of river swamps from Connecticut, generally near the coast, to Georgia and western Louisiana, and in Arkansas, Tennessee, Kentucky, Illinois, and Indiana, reaching its best development in the basin of the lower Ohio river.

In this State, where it attains an average height of 70 to 80 feet, it is found in the rich swamp lands of the lower Cape Fear river, and probably elsewhere.

The leaves are ovate, serrate with blunt incurved teeth, and downy on the veins beneath.

The wood is light, soft, not strong, close-grained, compact; dull brown in color; the thick sapwood lighter.

Populus monilifera, Aiton.

(CAROLINA POPLAR. CAROLINA COTTONWOOD.)

A large tree, with dark brown rough bark and oval crown, reaching a height of 170 and a diameter of 8 feet.

It occurs from Vermont to Florida, and westward to Montana, Colorado, and New Mexico, growing in low moist soil. It is common in the West.

In this State, where it reaches an average height of 60 to 70 feet, it is rare, and is found in the Piedmont plateau.

It bears seed frequently in North Carolina but never abund-

antly. Young trees are common on bottom lands along streams. Stumps over 18 inches in diameter sprout freely in the open.

The leaves are broadly ovate, and serrate with large incurved teeth. The winter buds are conical, shining brown, and of moderate size. The Carolina poplar has numerous strong lateral roots.

The wood is very light, soft, not strong, close-grained, compact, liable to warp, and hard to season; dark brown in color; the thick sapwood nearly white. It is used for paper pulp, packing cases, fence boards, and fuel.

Thuja occidentalis, Linnæus.

(ARBOR VITÆ.)

An evergreen tree, of pyramidal habit, with a rapidly tapering trunk furnished with numerous small branches at irregular intervals, reaching a height of 60 and a diameter of 5 feet, or at its southern limits reduced to a very small tree or shrub.

It occurs from New Brunswick to Lake Winnipeg, south to New York, Pennsylvania, Illinois, and Minnesota, and along the Appalachian mountains to North Carolina, growing on wet soil. It is very common in the North.

In this State, where it is but a shrub or small tree, it is confined to the mountains.

The small blunt-pointed or awl-shaped leaves are thickly pressed along the branchlets in 4 rows. The flowers are very minute. The light brown cones are $\frac{3}{8}$ inch long, and each of the 6 to 12 oblong rounded scales protects 2 seeds.

The wood is very light, soft, not strong, brittle, and very durable in contact with the soil; light brown in color; the thin sapwood nearly white. It is used for fencing, telegraph poles, railroad ties, and shingles, and sometimes for cabinet work and building. An oil distilled from the leaves has been used in pulmonary complaints.

Cupressus thyoides, Linnæus.*

(WHITE CEDAR. JUNIPER.)

A slender evergreen tree, with numerous short spreading

*Chamæcyparis sphæroidea, Spach

branches which cover the greater part of the trunk and form a conical head, and reddish-brown deeply furrowed or loose bark reaching a height of 90 and a diameter of 5 feet.

It occurs in deep cold swamps from Maine along the coast to northern Florida and Mississippi, and is rare west of Mobile bay.

In this State, where it reaches an average height of 40 and an average diameter of 2 feet, it grows in wet sandy, often peaty, soils in the coastal plain region, extending westward to Wake and Anson

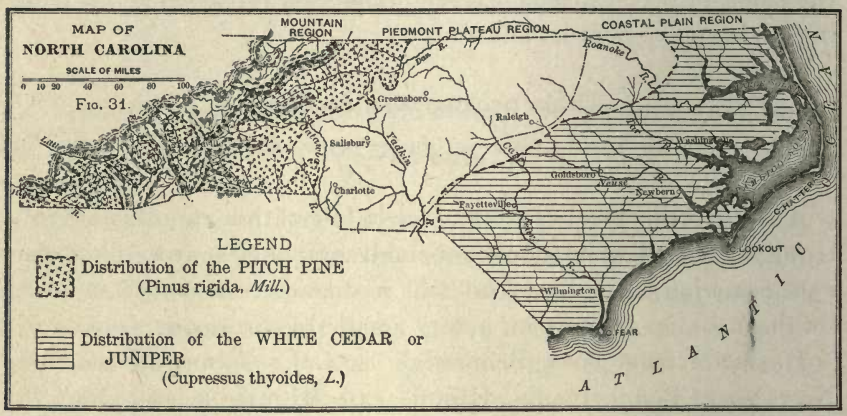


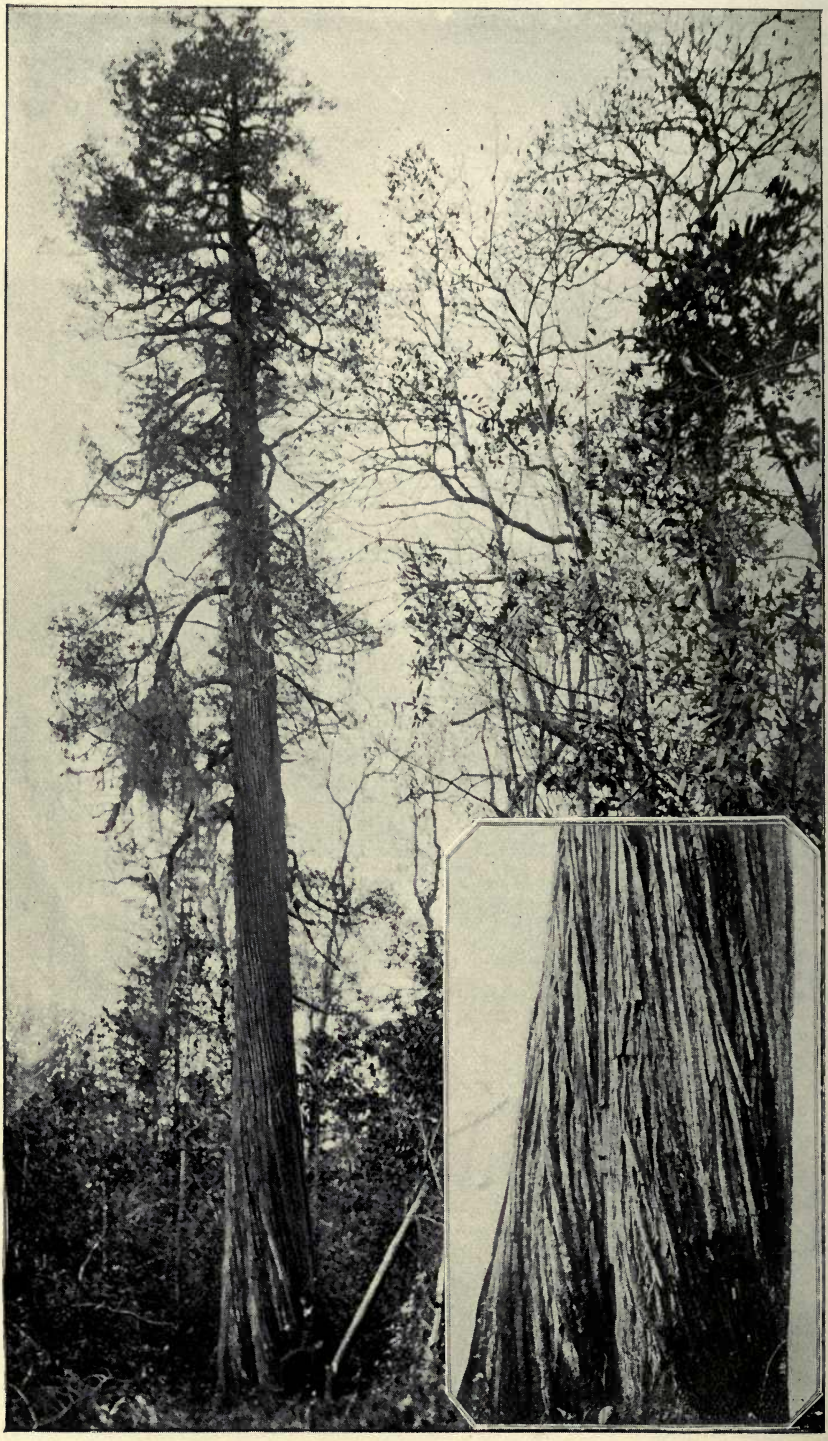
FIG. 31.

counties. (Fig. 31) It frequently occurs in pure forest, or with the white bay, or scattered in small clumps, in cypress and gum swamps.

The juniper bears seed very plentifully nearly every year. Seedlings are common near the parent trees, but usually die under deep shade. Fire is very destructive to trees of all ages, and extensive areas of valuable timber have been burned, particularly in the Dismal Swamp. In many swamps large quantities of fallen trees, sound and fit for lumber, lie buried at various depths.

The leaves are very small, ovate-pointed, awl-shaped, and closely appressed in 4 rows. The male and female flowers are separate but on the same plant; the male catkins cylindrical, the female globose. The cones are very small and globular, with thick scales bearing 2 or more seeds at the base. The juniper, at least in peaty swamps, has a poorly developed tap-root or none at all, and long strong superficial lateral roots.

The wood is very light and soft, not strong, close-grained, com-



RED CEDAR

pact, easily worked, and very durable in contact with the soil; light brown in color; the sapwood lighter. It is used for boat-building, woodenware, cooperage, shingles, interior finish, telegraph posts, fence posts, railway ties, and in the manufacture of lampblack. Charcoal for gunpower is made from the smaller trunks.

The original growth, in most accessible juniper swamps of this State, is being rapidly removed. There still remain, however, large quantities in Dare, Tyrrell, and Gates counties and in the Dismal Swamp, which are yet inaccessible.

Juniperus virginiana, Linnæus.

(RED CEDAR.)

An evergreen tree, with pyramidal head, numerous crowded drooping branches, and dark brown shaggy bark, reaching a height of 100 and a diameter of 6 feet, or at its northern and western limits often reduced to a low shrub. (Plate XIII.)

It is one of the most widely distributed North American trees, and occurs in all parts of the United States except western Texas, California, and Oregon; reaching its best development in the valley of the Red river, Texas.

In North Carolina, where it grows to an average height of 30 to 40 feet, and an average diameter of 10 to 13 inches, it is found

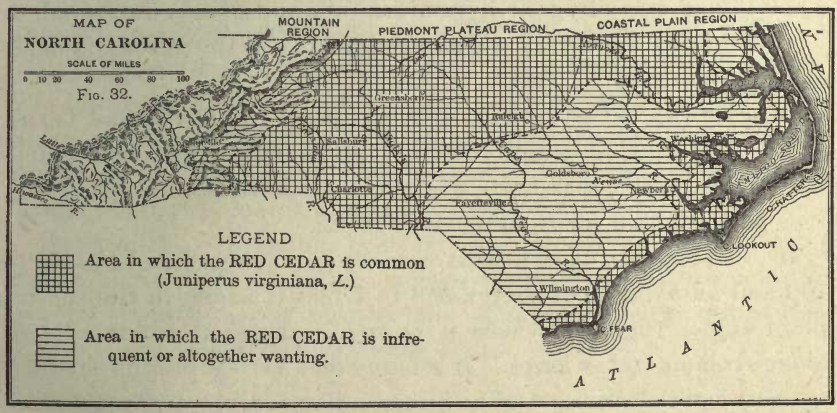


Fig. 32.

throughout, but is rare and of small size in the high mountain counties. (Fig. 32.)

The red cedar bears seed abundantly nearly every year. Young trees frequently form a large part of the growth on dry rocky fields and hillsides, particularly in the Piedmont plateau region. Young growth is often overtopped and crowded out by faster growing pines and oaks, although it can live in deep shade for a long time. Small specimens are very sensitive to fire. It is very free from the attacks of insects and from all fungal diseases.

The leaves are small, entire, scale-like, and sharp-pointed or obtuse. The flowers are small and inconspicuous, and the fruit is a small ovate smooth berry, dark purple, and covered with a glaucous bloom. On deep loamy soil the red cedar has a well developed tap-root and numerous deeply seated lateral roots.

The wood is light, soft, not strong, brittle, very close and straight-grained, compact, easily worked, and durable in contact with the soil; dull red in color; the thin sapwood nearly white. It is used for posts, sills, railroad ties, interior finish, cabinet making, woodenware, and for lead pencils to the exclusion of all other woods. The wood is odorous, and an infusion of the berries is used medicinally.

Taxodium distichum, Richard.

(CYPRESS. BALD CYPRESS.)

A large tree, of great commercial value, with deciduous leaves, a small flat spreading or pyramidal top, and deeply furrowed or loose reddish-brown bark, reaching a height of 150 and a diameter of 13 feet.

It occurs in wet situations from Delaware to Florida and Texas, and in Arkansas, Kentucky, Missouri, Illinois, and Indiana; reaching its best development in the south Atlantic and Gulf states. It is common and forms extensive forests.

In North Carolina, where it reaches an average height of 60 to 100 and an average diameter of 5 to 7 feet it occurs in the coastal plain region (fig. 33), where it is one of the most common trees along streams and swamps. It is found on a variety of soils between a heavy mud-alluvium and a light sand or rarely on peaty soil.

Although seed years are frequent, young plants are not common.

A growth of gums usually follows the cypress after lumbering. Large specimens have swollen butts which are often hollow. The

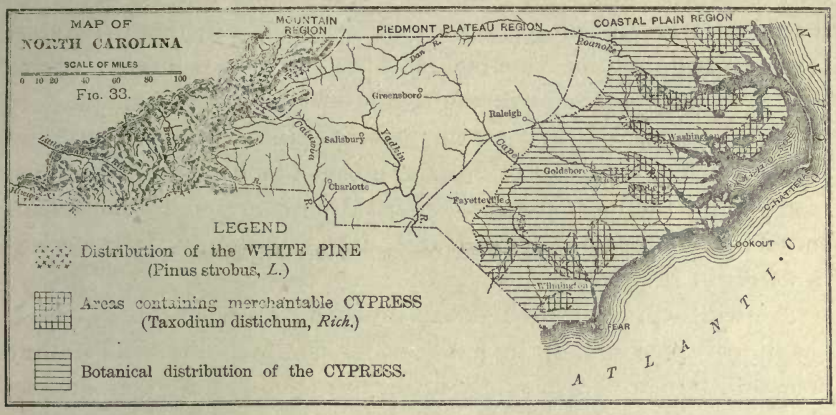


FIG. 33.

timber has frequently small hollows and rotten spots scattered through apparently sound logs.

The leaves are deciduous, flat, linear, and in two rows on the slender branchlets. The male and female flowers are borne on the same tree; the male in drooping flexible catkins, the female in ovoid catkins, singly or in small clusters. The fruit is a small dark brown globular cone with thick scales. There are many deeply penetrating lateral roots, and long superficial roots from which the "cypress knees" grow to a height of one to four feet.

The wood is light, soft, close and straight-grained, not strong, compact, easily worked, and very durable in contact with the soil; light or dark brown in color; the sapwood nearly white. The lumber is known commercially in two varieties, the black and white cypress, of which the former is heavier, harder, and more durable. It is used for construction, cooperage, railroad ties, fencing, shingles, water pipes, and interior finish.

Much of the cypress has been removed along the larger streams and from the more accessible swamps in the northeastern counties for the manufacture of lumber and shingles. Large quantities, however, are still standing in the State.

Pinus strobus, Linnæus.

(WHITE PINE.)

A large tree, of the first commercial importance, with horizontal

branches, and rough furrowed dark grayish-brown bark, reaching a height of 170 and a diameter of 11 feet. (Plate XIV.)

It occurs from Newfoundland to the Winnipeg river, south through the northern states to Pennsylvania, Michigan, Illinois, Iowa, and along the Appalachian mountains to Georgia; reaching its best development in the region of the Great Lakes.

In this State, where it attains an average height of 60 to 70 and an average diameter of 2½ feet, it is confined to the mountains. It grows for the most part at an elevation of 1,500 to 3,500 feet, and is found along the Blue Ridge, and scatteringly in the counties west of it. (Fig. 33, p. 123.)

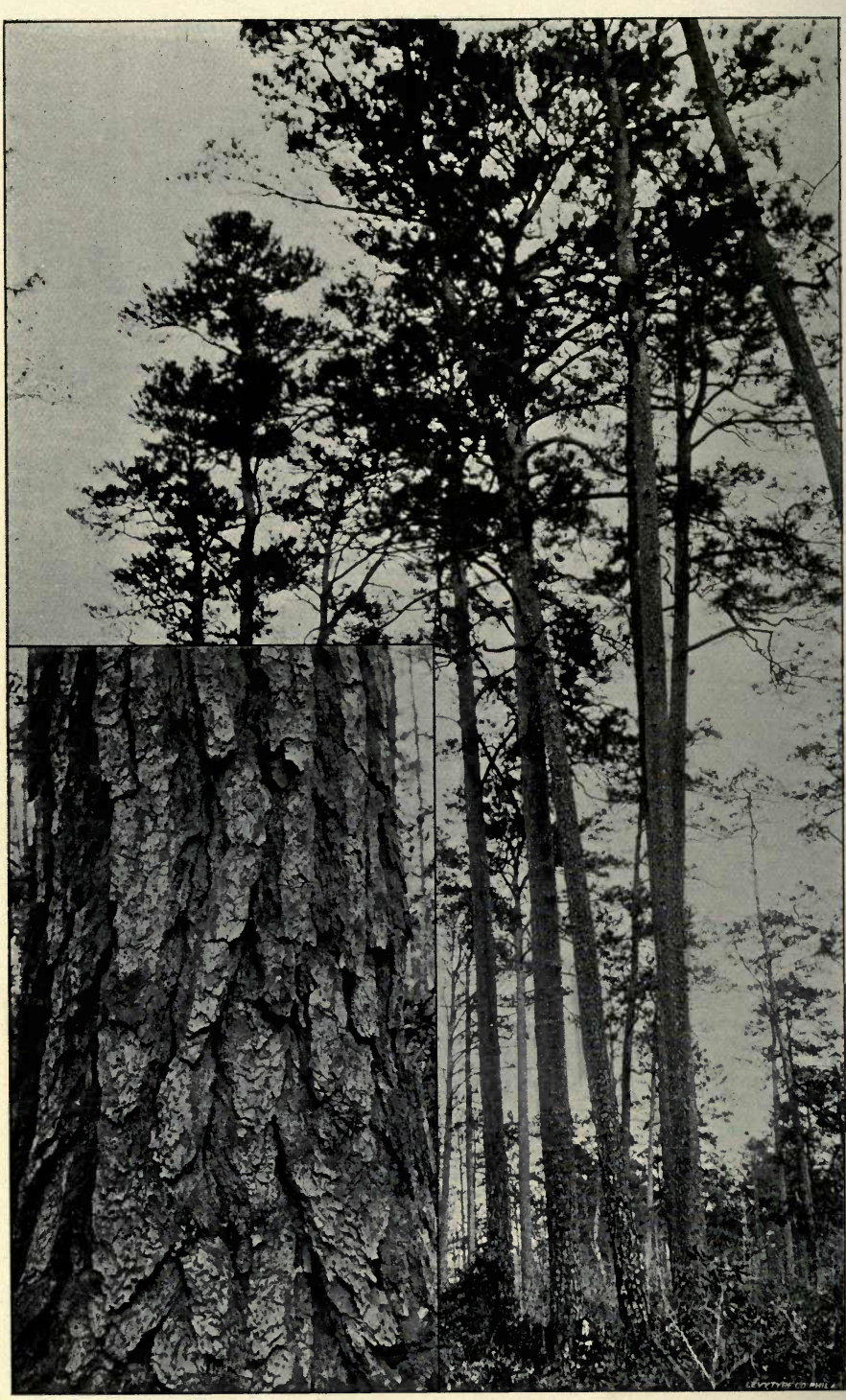
The white pine bears seed at intervals of from 2 to 4 years. Seedlings are common in open woods, and in old fields on dry poor soil. It prefers a sandy loam, but is found on clay and on sandy soil. It grows usually on rich land or on high dry stony ridges, and often forms large patches of nearly pure forest. The growth is slow for the first 4 to 7 years, then very rapid for 40 to 60 years, after which it again grows slowly. It is a long-lived tree, sound specimens having been found 350 or 400 years old. Specimens under 10 inches in diameter are sensitive to fire.

In the northern states the grub of the pine borer or sawyer, Monohamnus confusor, Kirby, attacks the sound timber, though less frequently than that of decaying trees. The white pine weevil, Pissodes strobi, Peck, causes a great deal of injury by entering and destroying the leaders. This species is also subject to the attack of the grubs of various bark beetles.

The leaves are soft, slender, in fives. The male catkins are oval, the female long-stalked and cylindrical; the cones long, narrow, slightly curved, and tapering to a point. The seeds are small, smooth, and ovate, with thin wings about 1 inch long. The roots, which are remarkable for their durability, usually do not penetrate deeply into the soil.

The wood is light, soft, not strong, very close and straight-grained, compact, easily worked; light brown in color; the sapwood nearly white. It is used for lumber, shingles, laths, building material, cabinetmaking, interior finish, matches, woodenware, and domestic purposes, and is altogether one of the most

A GROUP OF WHITE PINES



A GROUP OF LOBLOLLY PINES

useful timbers of the United States. Its threatened exhaustion is therefore a serious matter.

Pinus tæda, Linnæus.

(LOBLOLLY PINE. OLD FIELD PINE. SHORT-LEAF PINE. SWAMP PINE. SLASH PINE. ROSEMARY PINE. NORTH CAROLINA PINE.)

A large and valuable tree, with a long clear stem, a large ovoid crown, and reddish-brown bark divided into flat rectangular plates, reaching a height of 150 and a diameter of 5 feet. (Plate XV.)

It occurs from Delaware to Florida and Texas, generally near the coast, and north to the valley of the Arkansas river; reaching its best development in eastern North Carolina.

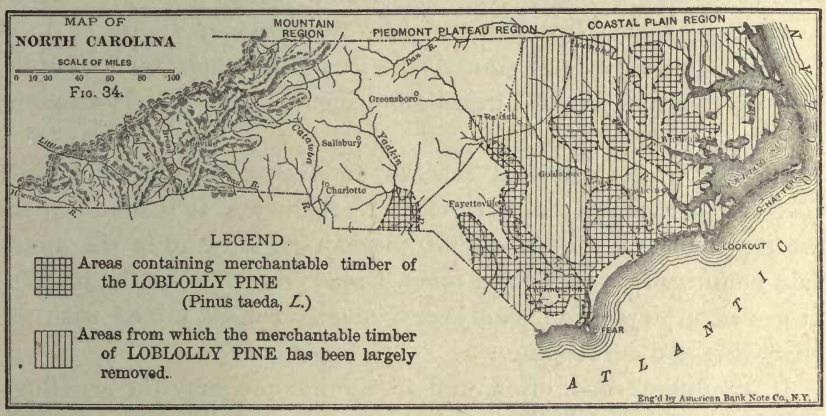


FIG. 34.

In this State (fig. 34), where it attains an average height of 50 to 70, and an average diameter of 2 to 3 feet, it is found on a great variety of soils and situations from the sea level to an elevation of 1,000 feet. The original growth is on moist deep soil, but the second growth has sprung up largely in old fields, often replacing the long-leaf pine on the moister loamy lands.

It bears seed generally every year, and abundantly once in 2 or 3 years, but much of the seed is imperfect. Seedlings are very common on rather moist soil in abandoned fields. The rate of growth, under sufficient light, is very rapid.

The slender light green leaves are usually in threes, with

rather long close sheaths. The cones are ovate-oblong and 3 to 4 inches long; the scales terminate in short rigid spines. This species has a tap-root and many strong deeply penetrating lateral roots.

The wood is light, not strong, brittle, very coarse-grained and not durable; light brown in color, the very thick sapwood orange or often nearly white. It is used for lumber and fuel. Turpentine is sometimes obtained from this tree.

Pinus rigida. Miller.

(PITCH PINE. BLACK PINE.)

A tree, with an oblong crown, spreading branches, a cylindrical, and often crooked stem, and rather flaky dark reddish-brown bark, reaching a height of 80 and a diameter of 3 feet.

It occurs from New Brunswick to the northern shores of Lake Ontario, south through the Atlantic states to northern Georgia, and westward to West Virginia and Kentucky. A very common tree.

In this State, where it reaches an average height of 50 to 70 feet and an average diameter of 18 to 24 inches, it is found in the western part of the Piedmont plateau region and in the mountain counties south of the French Broad river. (Fig. 31, p. 120.) It grows on dry, often sandy or gravelly ridges, mixed with the short-leaf and scrub pines.

It produces seed often and in abundance, and the seedlings, which require a good deal of light, are common in dry open situations, and in old fields. Young trees sprout from the stump to some extent, but the sprouts are short-lived. The resistance of the pitch pine to fire is exceptionally great.

The rigid flattened leaves are usually in threes, from short sheaths, and 3 to 5 inches long. The cones are ovate and from 2 to nearly 4 inches long, the scales armed with a short recurved spine.

The wood is light, soft, not strong, brittle, and coarse-grained; light brown or red in color; the thick sapwood yellow or often

POND OR SAVANNAH PINE

nearly white. It is used for fuel, charcoal, and coarse lumber. It has been sparingly cut for lumber in North Carolina.

Pinus serotina. Michaux.

(POND PINE. SAVANNA PINE. SWAMP PINE. POCOSIN PINE.)

A small tree, with a short cylindrical trunk, numerous short branches, and smooth dark brown bark broken into rectangular plates, reaching a height of 80 and a diameter of 3 feet. (Plate XVI.)

It occurs on low peaty or wet sandy soils of the worst quality, from North Carolina to Florida, near the coast.

In this State, where it reaches an average height of 40 to 50 feet, it is common in the small swamps of the coastal plain, and

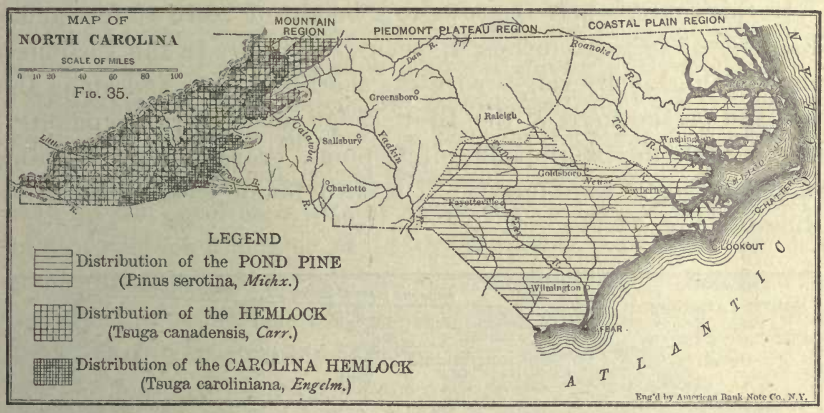


FIG. 35.

is occasionally found in the Piedmont plateau region. (Fig. 35.)

It bears seed frequently, and young growth is common on wet soil near old trees and mixed with the second growth of loblolly pine. A great deal of the seed will not germinate. It is more sensitive to fire than the loblolly pine. Old specimens are often hollow or red-hearted.

The leaves are in threes, 5 to 8 inches long, somewhat shorter and from shorter sheaths than those of the loblolly pine. The cones frequently remain on the tree several years before dropping their seed. They are round-ovate, 2 to 3 inches long, with scales rounded at the apex and have a small weak prickle.

The wood is heavy, soft, not strong, brittle, coarse-grained; dark orange in color; the thick sapwood pale yellow.

In some sections of the State the pond pine is manufactured into lumber with the loblolly, from which it is not distinguished commercially.

Pinus virginiana, Miller.*

(JERSEY PINE. CEDAR PINE. SPRUCE PINE. SCRUB PINE.)

A slender tree, with a short stem, very numerous limbs which form an open oval or conical crown, and red-brown frequently scaly bark, reaching a height of 120 and a diameter of 3 feet.

It occurs from New York, generally near the coast, to Georgia, and westward to Kentucky, and Indiana; reaching its best development west of the Appalachian mountains.

In this State, where it grows to a height of 20 to 40 feet and a diameter of 12 to 15 inches, it occurs sparingly in the Piedmont plateau on gravelly ridges with the short-leaf pine, and along the foot and on the spurs of the Blue Ridge much more abundantly, mixed with the white and pitch pines, or sometimes forming small patches of pure forest. It is also found west of the Blue Ridge. (Fig. 36.)

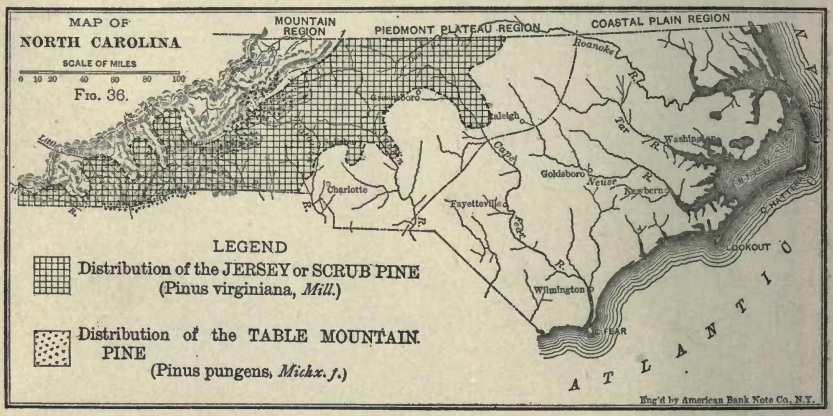


FIG. 36.

Seed is produced plentifully once in 2 or 3 years, and seedlings are very common, particularly in old fields, together with those

*Pinus inops, Aiton.

of the short-leaf pine. The rate of growth is very rapid, but the tree is short-lived.

The leaves are short, 2½ to 3 inches long, rigid, in short sheaths, and usually in twos. The cones are light brown, solitary, curved, and oblong-conical, the scales armed with a rigid prickle. The root system is inclined to be somewhat heart-shaped, with a well developed tap-root.

The wood is light, soft, not strong, brittle, close-grained and durable; light orange in color; the thick sapwood nearly white. It is used for fuel, water pipes, and pump logs. In North Carolina it is used in the manufacture of charcoal, and to some extent for fencing.

Pinus pungens, Michaux.

(TABLE MOUNTAIN PINE.)

A tree, with rough reddish-brown bark and a large spreading crown, reaching a height of 60 and a diameter of 3½ feet.

It occurs along the Alleghany mountains from Pennsylvania to Tennessee, where it reaches its best development. A common tree, sometimes forming pure forest.

In North Carolina it attains an average height of 30 to 50 feet, and an average diameter of 12 to 20 inches, and is found only along the Blue Ridge and the ranges immediately eastward on the driest, most barren ridges, usually associated with the pitch pine, and the chestnut and scarlet oaks. It is most abundant in the southeastern parts of Macon and Jackson counties. (Fig. 36, p. 128.)

It bears seed abundantly; seedlings are common in open woods near the old trees, and in abandoned fields.

The leaves are 2 to 2½ inches long, stout, and generally in twos. The light yellow very compact cone, 3 inches long and 2 inches broad at the base, has very broad strong sharp spines, 1-6 inch long, bent toward the top of the cone.

The wood is light, soft, not strong, brittle, coarse-grained; light brown in color; the thick sapwood nearly white. It is used for charcoal and to some extent in construction.

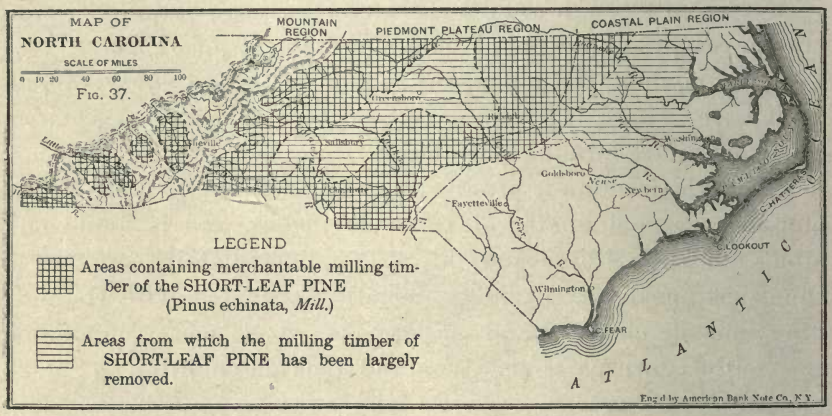
Pinus echinata, Miller.*

(SHORT-LEAF PINE. YELLOW PINE. SPRUCE PINE. ROSEMARY PINE. HEART PINE.)

A tree of commercial importance, with a long clear stem, a broad oval crown, and brownish-red bark broken into rectangular plates, reaching a height of 100 and a diameter of 4½ feet.

It occurs from New York to Florida and Texas, through Arkansas to Indian Territory, Kansas, and Missouri, and in Illinois; reaching its best development in Louisiana, Arkansas and Texas.

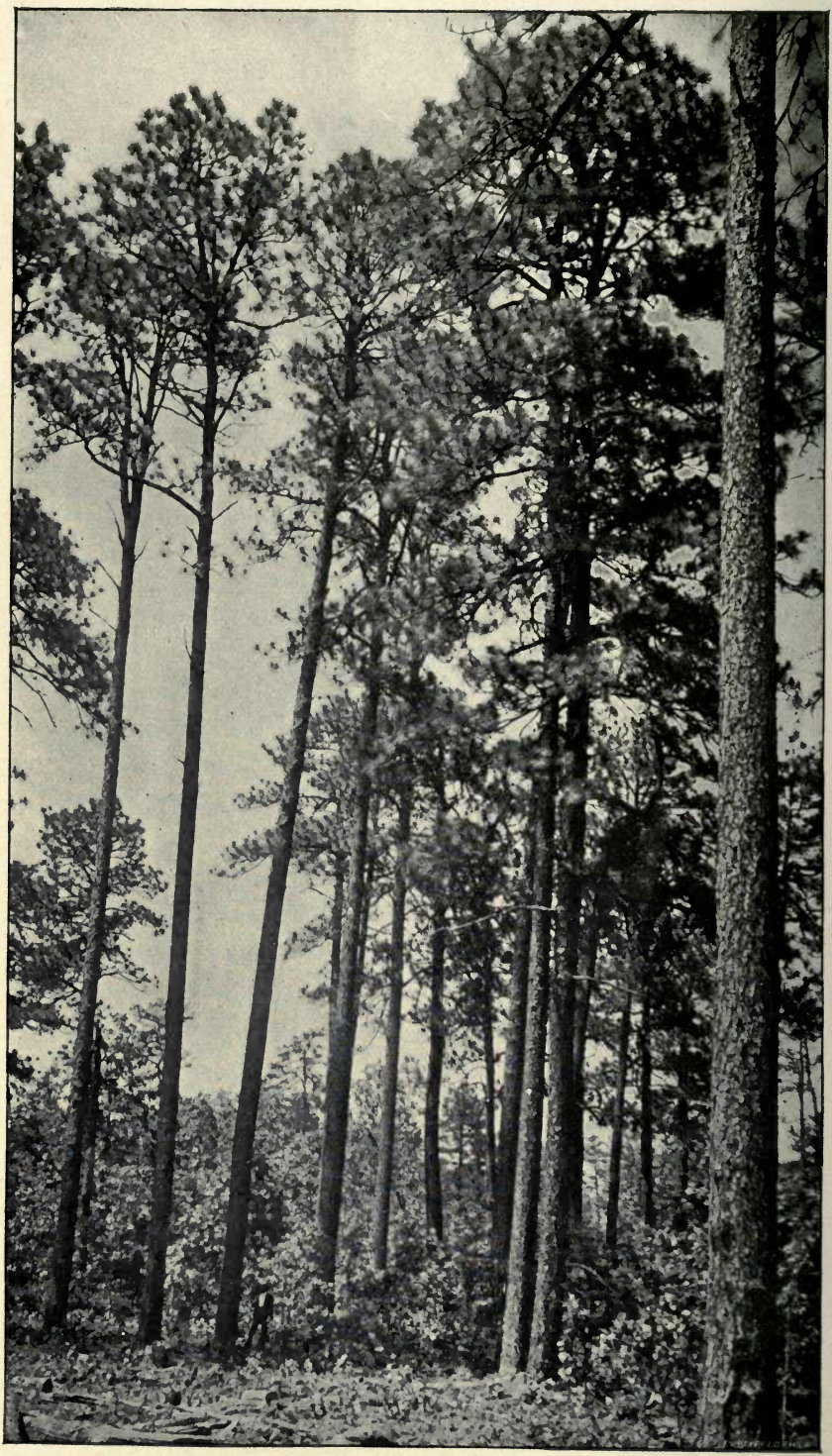
In North Carolina, where it grows to a height of 70 to 90 feet and a diameter of 2 to 3½ feet, it is found throughout, and enters into the composition of most upland forests. It appears less commonly in the coastal plain region, being especially rare south of the Neuse river. (Fig. 37.)



The short-leaf pine produces some seed annually, and bears abundantly about once in three years. Seedlings are common on well-drained soil, occupying abandoned fields and often growing in mixture with the loblolly pine. The rate of growth in youth is very rapid. On high exposed situations it is sometimes thrown by the wind.

The dark green slender leaves are usually in twos, from a long sheath, and 3 to 5 inches long. The cone, smaller than that of the other North Carolina pines, and armed with slender short

*Pinus mitis, Michaux.



A GROUP OF LONG-LEAF PINES

spines, is rarely 2 inches long. It has a strong tap-root and several lateral roots.

The wood varies greatly in quality and in the amount of sapwood. It is heavy, hard, strong, and generally coarse-grained; orange in color; the sapwood nearly white. It is much used for lumber, for which purpose it is only inferior to that of the long-leaf pine.

In the middle sections near the railroad it has been largely removed. Large quantities still remain, however, in Stanly, Cabarrus, Randolph, Caswell, Davidson, Surry, Wilkes, Alexander, Iredell, Yadkin, Cleveland, Rutherford, and Caldwell counties. The amount sawed in this State in 1894 probably was between 50,000,000 and 60,000,000 feet, board measure, the larger part of which was for local use.

On account of its tendency to spring up in old fields and open woods, and the excellent quality of its timber, the short-leaf pine is probably destined to assume very extensive economic importance in the future.

Pinus palustris, Miller.

(LONG-LEAF PINE.)

A tree of the first commercial value, with a long slender trunk free from branches, a small round head, and thin bright red-brown thin-scaled bark, reaching a height of 95 and a diameter of 4 feet. (Plate XVII.)

It occurs from Virginia to Florida and Texas, rarely beyond 150 miles from the coast, and reaches its best development in northeastern Texas on the gravelly uplands of the valleys of the Sabine and Trinity rivers.

In North Carolina, where it reaches an average height of 70 feet and an average diameter of 15 to 20 inches, it is found (fig. 38) in pure forest from the Neuse river southward, occupying all the highest and driest sandy lands from the coast to within a few miles of Troy, in Montgomery county, and Rockingham, in Richmond county. Only along its western limits does it occur associated to any extent with other trees. The long-leaf pine formerly extended in an almost unbroken forest to Virginia, but it has been either

entirely cut out or so much thinned that it is of little commercial value north of the Neuse river. The loblolly pine has for the most part taken its place, except on very dry and sterile soils.

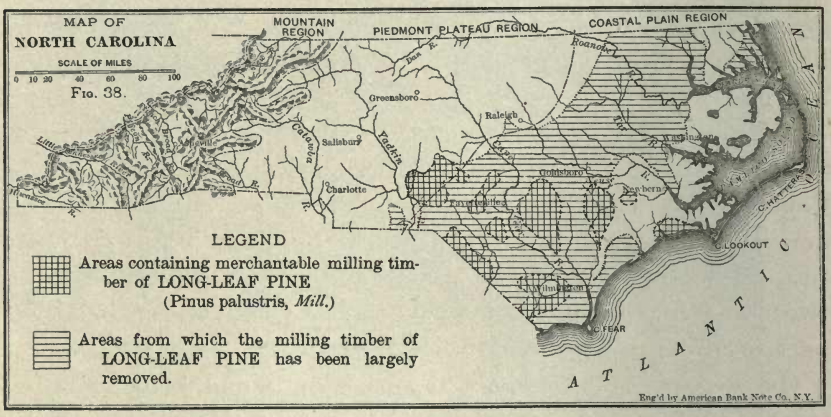
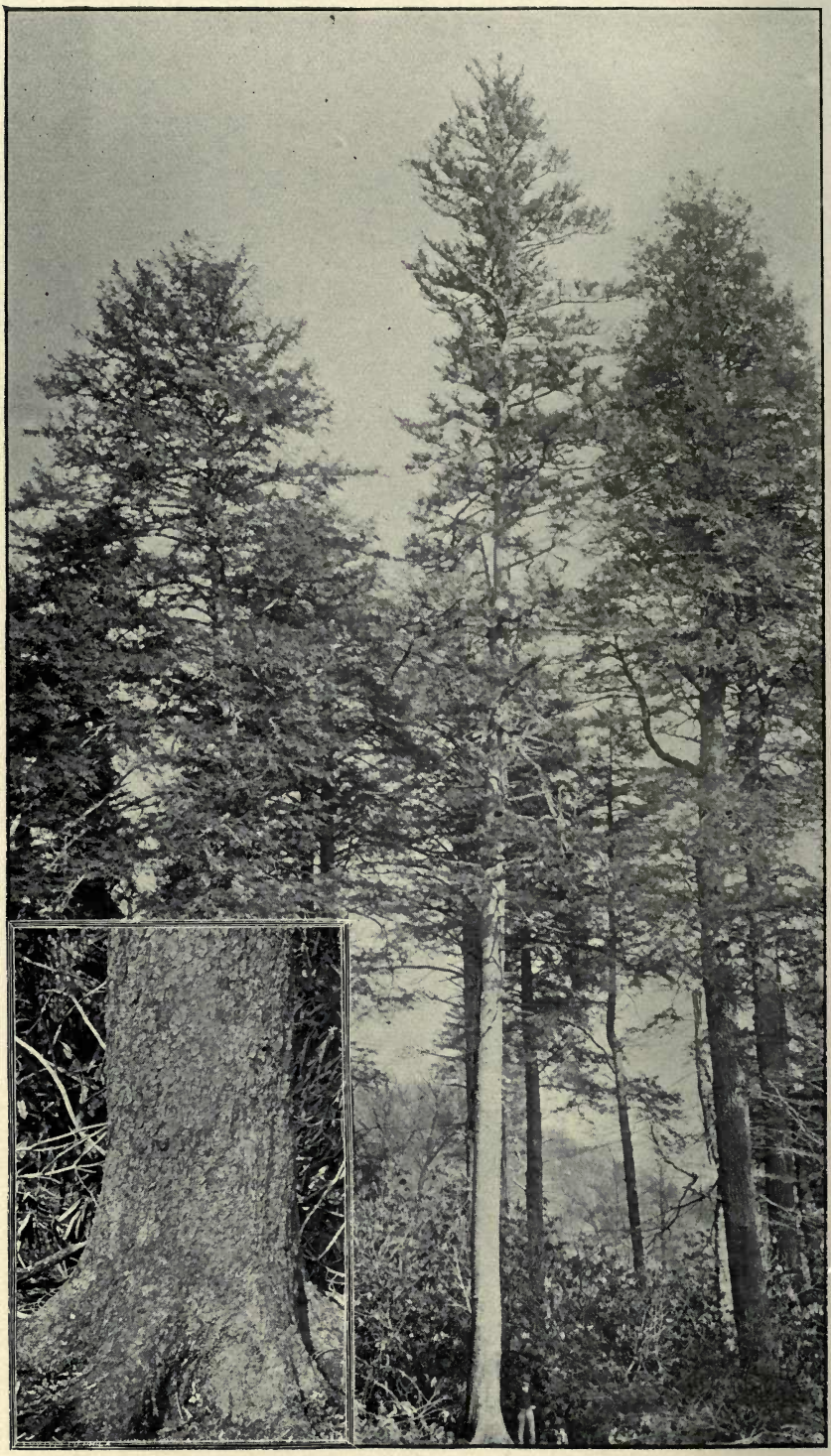


FIG. 38.

The long-leaf pine bears seed very abundantly only at long and irregular intervals. A fair production of seed occurs about once in 5 years, while in the intermediate years the yield is small and localized. After a seed year the young plants are very abundant throughout the woods, but are killed in large numbers either by forest fires, by the dense shade, or by swine rooting them up to devour the sweet tender roots. Young trees are very sensitive to fire. After the first four or five years trees in the open grow very rapidly until about 15 years old, particularly in height, after which time the growth is slow. When the long-leaf pine is cut or burned, and prevented from reproducing itself on account of fires and swine, the loblolly pine often follows on damp soils, and scrub oak or fork-leaved black-jack oak on high dry sandy lands.

The timber loss by fire on long-leaf pine lands in 1893 amounted to not less than $100,000. At rare intervals extensive tracts are destroyed by bark beetles. Scattered trees are injured in localities where the dead tops have been left in the woods after lumbering. Beetles attack trees which have been injured by turpentine operations, which often so weaken them that many are thrown by the wind. In 1893 the losses, principally through this cause, amounted to between ten and fifteen million feet, board measure.

The leaves are 10 to 15 inches long, in threes from long sheaths,



HEMLOCK

BLACK SPRUCE

and clustered on the ends of the thick scaly branchlets. They remain on healthy trees about 3 years, but on boxed trees only about two. The sterile flowers are rose colored, appearing about the first of April, and the large silky winter-buds are white. The cones are light brown, cylindrical or conical-oblong, 6 to 10 inches long, and have thick scales armed with a stout blunt spine. A tap-root is developed in early life and is often forked. The root system of old trees tends to be heart-shaped with the lateral roots penetrating deeply.

The wood is heavy, hard, strong, tough, coarse-grained, and durable; light red or orange in color; the thin sapwood nearly white. It is widely used for construction of all kinds, interior finish, fencing, railroad ties, etc. Turpentine, tar, pitch, rosin, and spirits of turpentine are obtained almost exclusively from this species.

The largest bodies of standing long-leaf pine are in Moore, Montgomery, Cumberland, Robeson, and Bladen counties, and probably not more than 50,000 acres still remain unboxed. Wilmington has for a long time been an important centre for the manufacture of lumber from this species, and much has also been cut in the Aberdeen district in Moore and Cumberland counties.

Picea nigra, Link.

(BLACK SPRUCE. HE BALSAM. LASH HORN. TAMARAC.)

A tree, with spreading branches which form a conical crown, a long cylindrical trunk, and dark brown scaly bark, reaching a height of 90 and a diameter of 4 feet. (Plate XVIII.)

It occurs from Newfoundland to Hudson bay, the mouth of the Mackenzie river, and the eastern slopes of the Rocky mountains, and south through the northern states to Pennsylvania, Michigan, Wisconsin and Minnesota, and along the Appalachian mountains to North Carolina.

In this State, where it is confined to the upper slopes of the highest peaks, above an elevation of 5,000 feet, from Elk Knob in Ashe to Clingman's Dome in Swain county, it forms pure forest or toward the summits is mixed with Carolina fir and

beech, and reaches an average height of 40 to 50 feet and an average diameter of 15 to 20 inches. In favorable localities at its lower limits, it attains a height of nearly 100 and a diameter of 4 feet.

It bears seed in abundance, in this State, only at long and irregular intervals. Young growth, however, is common in the thick woods.

Great quantities of spruce have been destroyed by bark beetles, notably in Maine and in the Adirondack mountains of New York. A bud worm, Tortrix fumiferana, Clemens, which attacks the shoots and foliage, is one of its most deadly enemies.

The dark green needle-shaped rigid leaves are scattered on all sides of the slightly downy branchlets. The cones are ovate or ovate-oblong and 1 to 1½ inches long, with thin roundish scales.

The wood is light, soft, not strong, close and straight-grained; light red, or often nearly white in color; the sapwood lighter. It is used for construction, shipbuilding, piles, posts, railroad ties, etc. Spruce beer is made from this species.

The largest bodies of spruce, in North Carolina, are on the Black mountains in Yancey county, Grandfather mountain in Watauga, the Balsam mountains in Haywood, and the Great Smoky mountains in Swain county.

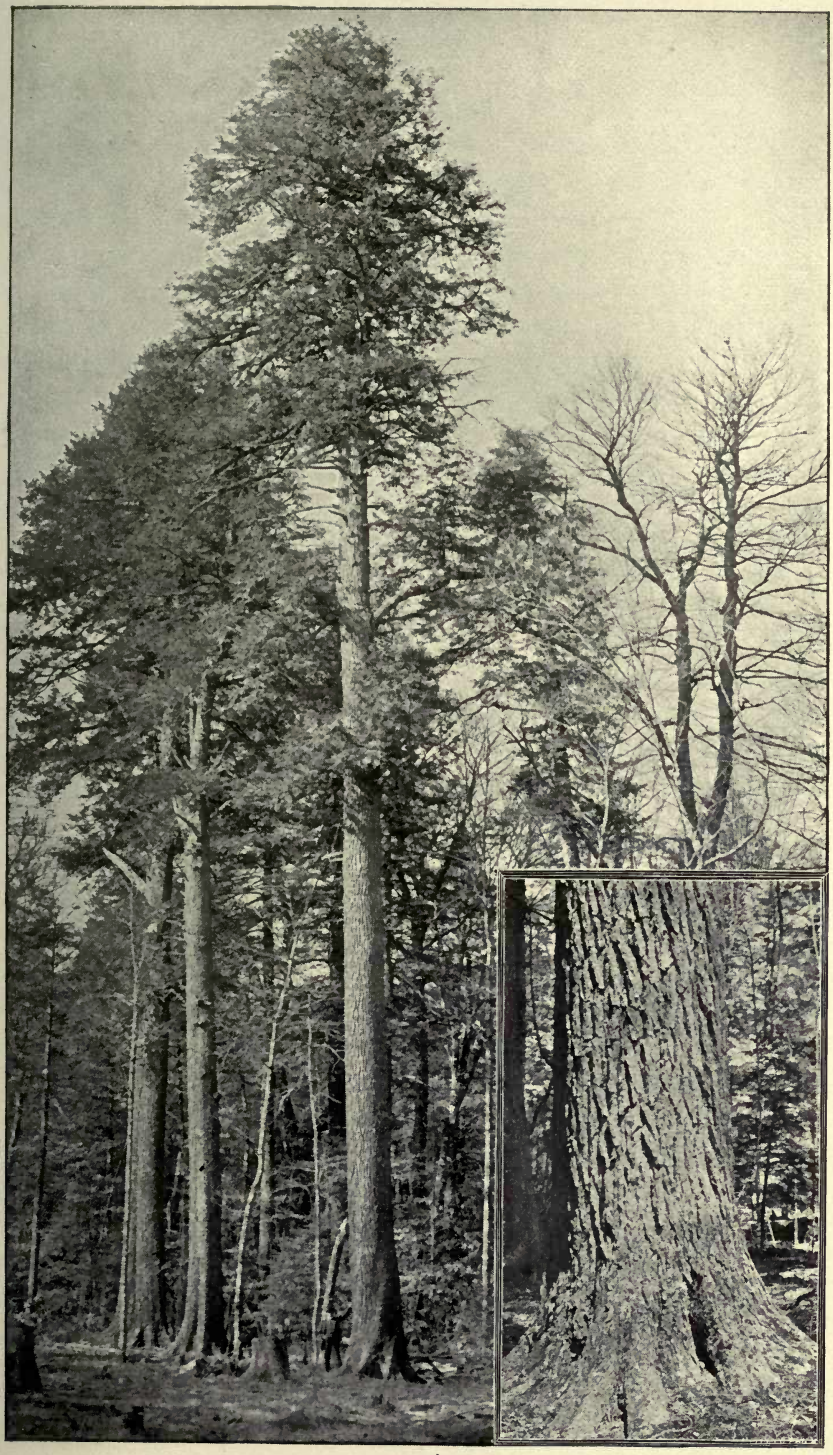
Tsuga canadensis, Carrière.

(HEMLOCK. SPRUCE PINE.)

A large tree, with a large conical crown, numerous spreading branches, and dark red-brown deeply furrowed bark, reaching a height of 110 and a diameter of 6 feet. (Plate XIX.)

It occurs generally on northern slopes from Nova Scotia to northern Wisconsin, and south to Delaware, Michigan, central Wisconsin, and along the Appalachian mountains to Alabama; reaching its best development in the high mountains of North Carolina and Tennessee.

In North Carolina, where it attains an average height of 70 to 80 and an average diameter of 2 to 3 feet, it is common in the mountains in cool ravines along streams on loamy or rich vegeta-



HEMLOCK

ble soil, associated with cherry birch, yellow birch, and the Rhododendron. (Fig. 35, p. 123.)

It bears seed frequently, and young seedlings are common in the shade of the old trees. The hemlock is very free from the attack of injurious insects. Tall trees in exposed situations are often thrown by the wind.

The dark green leaves are linear, flat, obtuse, two-ranked, and whitish beneath. The cones are small, oval or oblong, with the scales smooth and entire. The hemlock has numerous spreading lateral and superficial roots.

The wood is light, soft, not strong, brittle, coarse and crooked-grained, difficult to work, liable to windshake and splinter, and not durable; light brown or often nearly white in color; the sapwood somewhat darker. Commercially two varieties, the red and the white, are recognized. The coarse lumber is used for construction, outside finish, and railroad ties. The bark is extensively employed for tanning, and yields a powerful astringent. Canada or hemlock-pitch is made from this species.

A good deal of hemlock has been cut near Cranberry for the bark, and large quantities of logs have been floated down the branches of the Tennessee river from Graham and Swain counties to Knoxville, Tenn.

Tsuga caroliniana, Engelmann.

(CAROLINA HEMLOCK. HEMLOCK. SPRUCE PINE.)

A tree, with conical crown, numerous branches upon two-thirds of the stem, and rough thick red-brown bark, reaching a height of 50 to 70 and a diameter of 2 to 3 feet.

It is found locally along the eastern Appalachian mountains from the Saluda mountains, South Carolina, to Ashe county in North Carolina, where it occurs on cliffs along the South Fork of the New river, near Elk Cross-roads, and on spurs of the Blue Ridge; also in the gorge of the Doe river in Carter county, Tenn. (Fig. 35, p. 123.) It grows on dry and rocky ridges, rarely forming pure forest.

The Carolina hemlock bears seed frequently, but usually not in abundance. Seedlings are common in dense woods.

The leaves are longer and more scattered than those of the common hemlock, to which the tree bears a general resemblance. The cones are larger, drooping, and with spreading scales.

The coarse-grained brittle wood is light and soft; light brown tinged with red; the sapwood nearly white.

Abies fraseri, Lindley.

(BALSAM.)

A tree, with conical crown, numerous spreading branches, and light gray rather smooth bark, reaching a height of 80 and a diameter of 2 feet.

It occurs on moist slopes at an elevation of 5,000 to 6,500 feet, upon the mountains of North Carolina and Tennessee, often forming considerable forests.

In this State, where it reaches an average height of less than 40 feet and an average diameter of 12 to 15 inches, it is common on the highest summits of the mountain region, but it does not occur below 4,000 feet. It usually forms pure forest, but is found mixed with the black spruce, and to a less extent with beech and the birches.

It bears seed at rather long intervals, but seedlings are common under the shade of the old trees. The growth in youth is rapid.

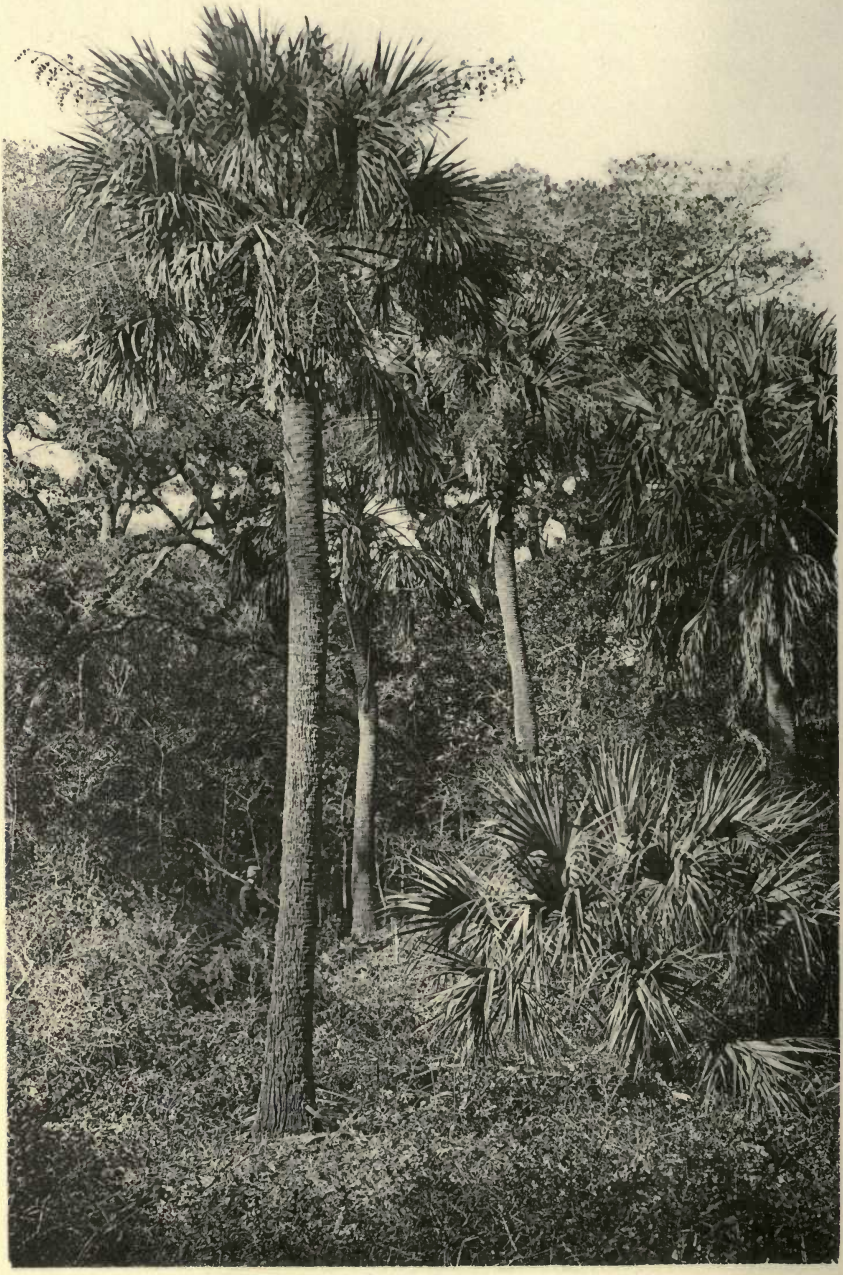
The leaves are somewhat two ranked, linear, flattened and obtuse, and remain on the trees for several years. The cones are 1 to 2 inches long.

The wood is very light, soft, not strong, coarse-grained; light brown in color; the sapwood nearly white. It is little used. A thin, clear liquid called turpentine or balsam, derived from blisters on the bark, is used for cuts and sores.

Sabal palmetto, Loddiges.

(PALMETTO.)

An endogenous tree, destitute of branches, with a small oval or



LIVE OAKS. A YOUNG PALMETTO.

A GROUP OF PALMETTOS. SMITH'S ISLAND.

globose head formed of the large round leaves, and rough furrowed dark brown bark, reaching a height of 40 and a diameter of 3 feet. (Plate XX.)

It occurs from Smith Island off Cape Fear river, North Carolina, to Key Largo, Florida, and along the Gulf coast to the Appalachicola river; reaching its best development on the west coast of Florida, south of Cedar Keys.

In North Carolina, it is found on deep sandy or loamy soil with the live oak, American olive, and water oak, and attains a height of 30 feet and a diameter rarely exceeding 18 inches. Its rarity renders it of little commercial importance.

The leaves are large, fan shaped, palmated, and borne on stems 18 to 24 inches long. The flowers are small, greenish, and in small clusters, and the fruit is a small rounded drupe.

The wood is light and soft; light brown in color; the fibro-vascular bundles hard, dark, and difficult to work. It is impervious to the attacks of the teredo, very durable in water, and is largely used for piles and wharves. The inner portion of the young plant is edible, and is often pickled.

FORESTS OF NORTH CAROLINA.

BY

WILLIAM WILLARD ASHE.

THE FORESTS OF NORTH CAROLINA.

By W. W. Ashe.

FOREST DIVISIONS.

North Carolina can be divided topographically into three well-marked divisions:

1. The coastal plain region, or coastal division lying to the eastward and extending inland from the coast for a distance of one hundred to one hundred and fifty miles, has an aggregate area approximating 24,000 square miles. Its surface is that of a gently undulating plain of slight elevation (ten to fifty feet above sea level) and more nearly level surface eastward, and becoming more elevated (three hundred to five hundred feet) and rolling along its western border. The upland soils are sandy loams and loams, rarely stiff, moderately fine and even-grained. To the north of the Neuse river loams and loose loams are the more frequent upland soils; to the south of this river they are more sandy. In the more eastern portion of this region, in the vicinity of the coast, are numerous and extensive swamps, due either to insufficient surface drainage, or the presence beneath the surface soil of impermeable strata. Their soils are silty and clayey, and compact; or sandy and loamy, and loose; over limited areas they are peaty; where they border the larger streams, that have their head-waters beyond the coastal plain region, they are silty with a small admixture of vegetable matter.

In this region the normal annual temperature is about 61°F.; and the normal annual rainfall about fifty five inches.

2. The Piedmont plateau region, extending westward from the coastal plain, lies parallel to the Atlantic shore, and to the Blue Ridge, the eastern base of which marks the region's western border. It is an extended peneplain, one hundred and fifty to two hundred miles in width, and has an area of about 22,000 square

miles. In the east its surface is rolling, but adjacent to the larger streams, and toward the western limit, it becomes more hilly and rugged, and in places even mountainous, being penetrated by spurs from the Blue Ridge. It has an average altitude above sea-level of 850 to 900 feet, but rises at the highest peaks to a little over 3,000 feet; along its extreme eastern border it is not over 400 to 500 feet. On the uplands the soils may be described in general terms as loams, sandy in some places and clayey in others, formed by the decay of slates, gneisses, granites, and other crystalline rocks. Along the numerous streams the soil is usually a fluvial deposit: a rich dark-colored loam, containing a varying proportion of vegetable matter.

The Piedmont plateau region has an average temperature of about 58.5° or 59° F., and an annual rainfall of about fifty inches.

3. THE MOUNTAIN REGION embraces an irregular and mountainous table-land, which lies between the escarpment of the Blue Ridge on the east and the Great Smoky mountains on the west. Numerous cross-chains, separated by narrow valleys or broader river basins, connect these two mountain ranges. The region has an average altitude above sea level of about 3,500 feet, but rises (at Mt. Mitchell) to 6,711 feet. It has an area of nearly 6,000 square miles. Although the mountain slopes are often steep, the soil is usually fertile, being a loam of varying physical character but generally rich in humus, open or porous and easily cultivated.

The average temperature for the region probably approximates 50° F., varying from 57.8° F., at Hot Springs, to an estimated temperature for the summit of Mt. Mitchell of less than 38° F.;* the normal annual precipitation is about 57 inches.

The rainfall throughout the State is about evenly distributed through the seasons; more falls, however, in July and August, and less in October and November, than at other seasons.

There are few late spring frosts; and only occasionally are there early autumn frosts before the wood has ripened at the end of the growing season.

*Climatology of North Carolina, N. C. Agr. Exp. Sta. Rept., Raleigh, 1892; p. 166.

Coinciding in general with the three topographic divisions described above are three well-marked forest divisions. That lying to the eastward will be called the *coastal plain forest region.* It includes the northern part of the great southern maritime pine belt which, more or less interrupted, but retaining its characteristic arborescent growth, extends from eastern Virginia to eastern Texas. It corresponds to the Louisianian zone of the biologists.

The second forest division will be considered as the *Piedmont forest region.* The forests of this region are typical of the hill-country of the South Atlantic and Gulf states, and corresponds to the Carolinian zone of the biologists.

The most western division will be considered as the *mountain forest region.* It forms almost the southern portion of the Appalachian forests which extend from northern Alabama to Pennsylvania and New York, and is the Appalachian life zone of the biologists. On the higher mountains, but on no peaks under 5,000 feet elevation, occur isolated groups of forests, which are referred by the biologist to a more northern zone, the Canadian; but these forests are not important enough, or sufficiently extensive in this State, to require more than a slight description.

FORESTS OF THE COASTAL PLAIN REGION.

The forests of the coastal plain region are characterized by a dominant growth of pines* on the uplands, except over limited areas where broad-leaf evergreen trees are dominant; and conifers of several species, associated with broad-leaf trees, many of them evergreen, on the lowlands.

The variations in the character of the forests of the coastal plain region are the result of the influences of three factors: (1) The maritime conditions, due to the proximity to the ocean and sounds, which perceptibly affect the composition of the forest only in the immediate vicinity of the coast; (2) elevation above the sea level, which is so slight as to cause evident effects only along the western limits of the region; (3) differences in the soils, to which is largely due the distribution within the region of the

*Pines occurring over the larger portion of this region all have 3 leaves to the sheath.

economic forests. The influence of the two first factors is through the temperature and relative humidity of the locality affecting the length of the growing season, the average annual temperature, and the amount of heat, or the extremes of heat or cold.

The conjoined effects of these factors separate the forests of the coastal plain region into three parallel zones or belts: (1) The maritime forests, lying to the eastward along the coast, and under the influence of the sea; (2) the forests of the pine belt; (3) the transitional forests lying along the western border of the region.

MARITIME FORESTS.

The maritime forests, extending northeast and southwest along the entire coast-line, rise from high-water mark, cover the narrow islands, the so-called banks skirting the coast, and on the mainland extend inland for a short distance, fringing the margins of the numerous streams, bays, and inlets about as far as tidal effects occur. This area is only a few hundred square miles in extent, having a length of about two hundred and fifty miles and a breadth in this State rarely exceeding four or five.

THE SOILS OF THE MARITIME DIVISION.

The upland soils of the maritime forest belt are of sand or exceedingly loose sandy loams, in a few places calcareous or limy; being sea beaches, or the remnants of former beaches lying within the existing one, and bordering the sounds and the narrow inlets. There is scarcely a differentiation into soil and subsoil, except occasionally in the larger proportion of organic matter contained in the superficial layers. Both upper and lower layers are identical in consistency, formed of large-sized and even-grained sand, with a small proportion of lime, in the form of calcium carbonate, from the weathering and disintegration of marine shells. The land surface rises usually only a few feet above high tide, though in a few places there are altitudes of 40 feet or more. Where the soils are fine-grained they are continually moist from water suspended by capillarity; where coarser and porous, they are soon dry, superficially, even soon after rains. The surface is

rolling, and in a few places there are hills with broad rounded crowns, where the force of wind and surf has lifted the loose sand high above the general level.

CONDITION OF THE FORESTS.

The forests of this maritime area are composed chiefly of broad-leaf evergreen trees: water oak, laurel oak, live oak, devilwood, mock-orange, smooth sweet bay, palmetto, yaupon and myrtle, with a single resinous species, the red cedar; while broad-leaf deciduous trees are represented chiefly by the southern lin, prickly ash,* buckthorns, planer-tree and water hickory, but these are not abundant, and are nearly confined to the alluvial soils or those richest in organic matter. The laurel oak and live oak are the most characteristic trees, being common throughout, and not being found in this State farther inland; although to the southward, following the isothermal, they occur far from the coast. Other trees which in this State are limited in their distribution to the maritime forests, are the devilwood, mock-orange, smooth sweet-bay, palmetto, planer-tree and magnolia. The water hickory, found on the banks of the larger streams, extends a few miles farther inland than most of these trees, and the same may possibly be true of the planer-tree; while the water oak, red cedar and one species of buckthorn extend to within the Piedmont plateau region.

The growth of the original forest where it is yet preserved is from 40 to 60 feet in height, the trees short-boled, the crowns large and spreading, interlaced into a dense canopy. Water oak, laurel oak, live oak, red cedar, smooth sweet bay, holly, and mock-orange, in relative abundance about in the order named, constitute from one-half to over three-fourths of the growth. Where culling has been carried on occasional loblolly pines have gained a foothold, or abundant-seeding species like yaupon, red cedar and the laurel oak have greatly multiplied.

Beginning at the Virginia line and passing to the south, there is a constant increase in the number of species present, so that while only a few species are represented beyond the Albemarle sound the number reaches a maximum in this State at and around

*See p. 19.

the mouth of the Cape Fear river, where at least two species find their northern limits. This enables the maritime forests to be roughly separated into two divisions: one lying to the north of Cape Hatteras, which point may be considered to mark the division between the two; and the other to the south of this cape. In the northern division, water oak and live oak, and red cedar form nearly the entire arborescent growth; while in the southern, with these occur the laurel oak, mock-orange, and, but irregularly distributed, the palmetto, devilwood, and magnolia. The palmetto is confined to Cape Hatteras and Smith's Island, the magnolia to the coast region of Brunswick county.

Where the soils are more moist, the growth is largely of water oak and laurel oak, holly, smooth sweet bay, and mock-orange, with occasional lins, or other kinds of oaks in addition to those named above, which form a dense upper story; beneath them are small shade-bearing trees or shrubs. The forest floor is good and the humus deep. Where the soils are drier, either from greater coarseness of the sand or from being more elevated above sea level, red cedar, live oak and prickly ash, enter more largely into the composition of the forest, the trees being smaller in size and with shorter boles. On the driest soils, the growth is restricted to scattered groves of red cedar, half shrubby forms of the live oak, thickets of plum and yaupon, and other shrubs which rapidly propagate by means of root-shoots and suckers.

Probably not over one-half of the area is wooded; the remaining portion is naked, only a small part of it being under cultivation. In places along the coastal islands, and this is particularly true to the north of Cape Hatteras, there are great stretches destitute of all tree growth, the soil being a coarse beach-sand, the surface of which rises into parallel ridges which reach a height, in places, of 70 or more feet above sea level; and this sand, being fixed by no network of plant root-fibers, and containing no binding ingredient, is constantly shifting under the impact of the winds. Some such areas were originally forest-covered, but once cleared, and the humus, which was slightly cohesive, destroyed, the constant movement of the sand before the winds, which have piled it into shifting dunes, has prevented a general growth of any kind from secur-

ing a foothold. Fishermen's houses have been destroyed by these moving dunes and their sites obliterated, and others are menaced by them. Considerable areas of forest have been destroyed by the roots of trees being deeply covered with sand or the entire forest buried, thus increasing the extent of the shifting dunes. Occasional clumps of prickly ash and devilwood, which put forth adventitious roots from the young twigs as they are partly covered by the sand, or thickets of shrubby live oak, plum, and shrubs which sucker freely, maintain themselves in some places for many years. All oaks, except the youngest, are killed by such moving dunes. Red cedar, holly, palmetto, mock-orange and myrtle, not rooting from the young wood, are quickly destroyed by the covering of sand.

A maritime dune, over two miles in length and twenty feet in height, is now moving across Smith's Island, which lies at the mouth of the Cape Fear river. Starting in the southwest part of the island, and moving to the northward, it has already destroyed the forest along the southern edge of the island.

Commercially these forests are unimportant except where they produce, on some of the islands, a limited number of red cedar posts. Their protection is worthy of consideration, however, as they act as a safeguard in preventing the formation of inlets which would impair existing water-ways.

THE FORESTS OF THE PINE BELT.

These forests extend from within a few miles of the sea coast inland to near the western limits of the coastal plain region, and embrace the greater portion of the economic forests of the region as well as cover the greater part of its area.

FOREST TREES.

The pines growing in this pine belt are the long-leaf, the loblolly, the pond and in some places the short-leaf. They are for the most part confined to the uplands, and form the dominant growth with broad-leaf trees beneath them, or occur as a pure growth. Other coniferous or resinous trees found are the cypress, white cedar, and red cedar, all of which in the original forests are

confined to the lowlands. The broad-leaf trees are chiefly water oak, willow oak, Spanish oak, swamp chestnut oak, overcup and post oaks, and such smaller species of oak as upland willow oak and the black-jack oak, which, though very abundant, are at present economically of little value; sweet gum, water gum and tupelo, elms, red maple, hackberry, hickories (chiefly the white, shagbark, and bitternut), and dogwood.

The larger broad-leaf trees, with the cypress and cedars, are confined to the lowlands and better class of soils, pines superseding them on the drier or impoverished soil of the uplands.

DISTINCTIVE GROWTH.

The difference between these forests and those of the maritime division are marked: The latter are composed mostly of broad-leaf evergreen species; the former are composed largely of pines and broad-leaf deciduous trees. A few trees are common to both forests. Thus the water oak is a conspicuous tree in both; but the red cedar is infrequent or altogether wanting over the larger part of the area of the pine belt. The smooth sweet bay of the maritime belt is represented in the pine belt by the closely related sweet bay. (See p. 26.)

PHYSICAL CHARACTERISTICS OF THE PINE BELT.

The surface of this part of the coastal plain region is gently rolling, there being, particularly to the eastward, areas of large extent almost level, but along the western border, especially in Harnett, Moore and Richmond counties, it is hilly and broken. The area is nearly as great as that of the coastal plain forest region, and the altitude above the sea level is about the same as was given for that, being from 10 or 15 feet along the eastern border to 150, and even 300 feet, in Moore county, along the western border.

To the eastward, in the neighborhood of the coast, where the drainage is insufficient to remove the rainfall, there are extensive areas of lowlands or swamp, mostly forest-covered; while westward, where the fall permits more thorough drainage, the swamps are restricted to narrow borders contiguous to the streams. The

entire swamp-area of the region aggregates nearly 4,600 square miles.

THE CHANGES IN THE KIND OF FOREST GROWTH.

The changes in the condition of the forest growth are due almost entirely to variations in the character of the soils: porosity, fertility, the amount of moisture contained in them, and to the distribution of the soil-moisture during the growing season. The extremes of moisture encountered are from wet, or even inundated soils throughout the growing-season, to dry soils for the greater part of the year, except immediately after a rain. In fertility the range is between compact and fine-grained "mud" alluvium, containing in abundance all the elements of plant-food, to almost pure sand; in porosity, from coarse-grained sand of great depth, to compact shallow top-soils with impermeable substrata. Some soils are almost destitute of humus, while others are constituted largely of decaying or decayed vegetable matter. Such extremes of soils are often in juxtaposition, there being no easy gradation from one to the other, so that the contrast and line of demarcation between the two, and the respective arborescent growth which they support, is sharply and distinctly defined.

The forests of the pine belt are separable into two groups: those of the uplands, on which the long-leaf and loblolly pines are the dominant trees; and those of the lowlands on which white cedar, cypress, or broad-leaf trees are the most abundant.

THE FORESTS OF THE PINE BELT UPLANDS.

Forests of pine covered, at least in their original distribution, all of the uplands, there being only a few local areas on which broad-leaf trees were not subordinate to them. To the north of the Tar river, except on the porous and highly silicious soils where pure and uninterrupted forests of long-leaf pine occurred, the original forests were composed of alternating belts of short-leaf and loblolly pines; the short-leaf pine, with a subordinate growth of broad-leaf trees, largely oaks, dominating along the crests and on the drier and more gravelly soils, as occasional trees of this species still standing now testify; while on the lower, moister, loamy

soils grew the loblolly pine, forming a ruling pure growth or coordinate with broad-leaf trees. To the north of the Roanoke river the long-leaf pine probably formed only two extensive forests: one on the sandy area extending north and south through Gates county, the other on "long ridge," an elevated body of sand lying to the south of the Dismal Swamp. To the south of the Roanoke river, the areas of sandy soils with the accompanying growth of long-leaf pine were more frequent, extensive bodies occurring in Halifax, Bertie, and Edgecombe counties; while in Wayne and Nash counties, to the north of the Neuse river, began the forests of this tree, which extended with their continuity scarcely b oken except by the water courses, west to the oak uplands of the Piedmont platean and southwestward to the Gulf of Mexico. Within this area, only adjacent to the swamps were there at the first settlement of this country more than scattered trees of the loblolly pine.

The influence of man in changing and modifying the distribution of these trees in the two hundred years that have followed has been enormous.

To the north of the Neuse river the long-leaf pine has nearly disappeared. Occasional solitary trees are still to be found among other kinds of pines, or broad-leaf trees, and on the sand hills of Wayne county, and in the flats of the great Dover swamp, groups of a few trees yet occur; but their commercial value as forest trees in this section has passed away. The short-leaf pine has as thoroughly disappeared from the counties lying to the north of the Tar river as has the long-leaf; the loblolly pine with an accompanying growth of small broad-leaf trees has succeeded both.

At the present time the forest of the uplands are separable into two divisions with distinct arborescent growth:

(1.) That in which the long-leaf pine is the dominant economic tree: the long-leaf pine woodland.

(2.) That in which the loblolly pine is the dominant economic tree: the level pine woodland.

In the present aspect of the forest there is no sharp line of demarcation between the two, but a differentiation is made for simplifying their consideration, as there are large areas, particu-

larily to the south of the Neuse river, on which the two trees occur side by side forming about equal proportions of the woods, but in such places the loblolly pine is in process of supplanting the long leaf pine, and such woodland will be considered from a sylvicultural point of view, as being more suitable for the growth and development of the loblolly than the long-leaf pine. The commercial timbers of each kind now on these lands will, however, be considered.

LONG-LEAF PINE WOODLAND.

The area on which the long-leaf pine is the dominant tree, or where it yet exists side by side with the loblolly pine, extends from near Bogue sound in Carteret county, southward along the great sand bank lying between the sounds and the swamps; from the borders of the Dover swamp northward to Enfield in Halifax county, and Nashville (within the transitional division) westward to Cary (in Wake county), Sanford (in Moore county), and the eastern edge of Montgomery county, and the southeastern corner of Anson county. To the northeastward of this area, wherever the soil was suitable, the long-leaf pine has been replaced by the loblolly; but on limited areas of sandy soils, occasional specimens of the former species yet stand, unsurrounded by other large forest trees, but showing that its fellows once tenanted the entire soil. Such areas will be fully described in considering the pine barrens.

Along the great sand hills just within the sounds, the long-leaf pine occurs in open forests of small trees, now largely removed; further inland, on the praries and hillocks in the swamps and the wet-soiled downs of the coast of Brunswick county, clumps of larger trees grow at intervals; on the loams in the basins of the Black and Northeast Cape Fear rivers, and on similiar soils in Columbus, Bladen, and Robeson counties, the long-leaf and loblolly pines are found together; while northward to northern Wayne, and westward to Wake and Anson counties, it forms, where unlumbered or not destroyed, a nearly pure growth of medium-sized trees.

Leaving out of consideration the few trees disseminated through

the swamps on hillocks, the long-leaf pine occurs on two classes of soils:

(1.) The sands of the pine barrens, which include the drier forest lands between the sounds and the great swamps, and the greater areas of dry sandy soils lying in the western parts of the coastal plain.

(2.) The loams of level pine woodland which are at present in most places the debatable ground between the long-leaf and loblolly pines, and are, in certain sections, largely occupied by the latter species. Such areas on which the loblolly pine is now dominant will be described in considering that tree.

In the forests on both kinds of soil dissimilar changes in their composition are in progress, the result of nearly the same factors

THE PINE BARRENS.

The largest detached areas of pine barrens are the long ridge, lying to the south of the Dismal Swamp, the areas in Gates and Green counties, the one to the north of the Neuse river in Craven county, narrow strips lying north and south in Pender and Duplin counties, a great part of New Hanover county, considerable areas in the southern part of Bladen, the middle and southern parts of Wayne and Columbus, and a narrow belt lying between the vast coastal swamps and the coast in the counties of Brunswick, Onslow, and Carteret; while a single large body extends from the northern part of Sampson, the southern and central parts of Harnett, northern and eastern portions of Bladen, and northern Robeson counties throughout Cumberland to the western sections of Moore and Richmond counties.

SOILS OF THE PINE BARRENS.

The soils are of almost pure sand, containing very little clayey ingredients; loose, coarse-grained, dry on the surface, even soon after a rain, fresh below, but becoming dry to a considerable depth, and usually with no differentiable subsoil. But in the smaller areas there is a top-soil of sand, often shallow, especially around the edges where stiffer loams form a more fertile subsoil. Geologically they are of recent date.

The distinctive arborescent growth of these lands is the long-leaf pine and several small scrub oaks; the fork-leaf black-jack oak, barren willow oak, and forms of the post oak.

CONDITION OF THE FORESTS OF THE PINE BARRENS.

Generally the pine forests of the barrens resemble a two-storied high forest, there being an upper story of this pine, about 70 or 80 feet in height, with a rather thin cover, even where uninjured by fires or unlumbered; beneath the pine an open growth of the scrub oaks from 10 to 15 feet in height, or in places nearly clear. As the cover of the pines becomes thinner, the scrub oaks beneath them become more numerous. The floor is poor, and there is but little humus; it is grassy with coarse tufts of the wire grass or broom grasses or covered with shrubs. There is no young growth of the long-leaf pine or any valuable tree.

Practically all of the pine has been tapped for its resin, crude turpentine, the amount of round-timber standing, which has not had the trunk excorticated in the process of turpentining, being less than 50,000 acres. Not only has the greater portion of the timber been so boxed for turpentine, but, after the original faces have been scarified as high as possible, and the trees allowed to rest a few years, additional boxes have been cut between the former ones. Many trees, thus weakened by the deeply cut boxes at the collar of the trunk, windfall, and the loss of timber from this cause has been enormous. The resin-covered surfaces where tapped for turpentine are highly inflamable, and fires passing over the dry herbage spread to the trees and frequently destroy them.

This description represents the forests where they are in the best condition, but it is now realized in only a few places in North Carolina.

The greater portion of the forests have been culled for many years, so that there are extensive areas thinly stocked, a few pines to each acre standing in thickets of scrub oaks; or there are large areas of abandoned turpentine orchard, aggregating probably 700,000 acres, but yet containing a small amount of timber suitable for saw logs. There are extensive areas lying within these forests from which the timber has been so thoroughly removed by

fires, lumbering, and a reckless system of turpentining that the lands may be classed as waste, there being on them neither merchantable trees nor young growth of any species which will, in the course of time, yield timber. Nearly all of the waste land in the eastern counties lies in the pine barrens, the larger areas being in Wayne, Sampson, Bladen, Brunswick, Harnett, Cumberland, Moore, and Richmond counties. The entire area of waste land is about 400,000 acres.

The waste lands are due to the failure of the long-leaf pine to reproduce itself to any considerable extent in these vast areas. Their present condition has been gradually matured, and the causes which have produced it may now be seen in operation in nearly any unprotected wood of long-leaf pine, where there is no young growth of this tree. The scanty reproduction is due largely to the fires which in many places pass over the land every year consuming the dead herbage, the wire grass and the leaves of the scrub oaks, and destroying the slow growing young pines, which by the end of the fifth year have only reached a height of 3 to 5 inches above the ground; the infrequent seeding of the old trees; the enormous destruction of the seed by hogs and fowls when there is a seed-year; the further depredations made by hogs digging up the plant to get the root. It is doubtful if the partial shade of the scrub oaks is sufficient to interfere seriously with the development of the young plant, as great as are its requirements for sunlight and warmth.

The failure of the forests of long-leaf pine to reproduce themselves naturally, except to a limited extent, on any part of the pine barrens, has already been treated of in a previous report of the Geological Survey. It is a matter of importance, as the land in its present state represents a great amount of capital lying idle which might be made productive to the owner, and give employment to labor engaged in handling or manufacturing forest products. It is absolutely essential that the demands necessary for its growth be accorded it—immunity from destruction by fires, protection against the depredations of stock, particularly hogs, both to the seed and the young plant, and protection against the

encroachment of more rapid-growing pines or broad-leaf trees, on soils where such will grow.

POSSIBILITIES OF THE PINE BARRENS.

The pine barrens, on account of their impoverished soils, are incapable of sustaining a wood of a large-sized broad-leaf species. The loblolly pine seems incapable of naturally securing a foothold in these sands, as nowhere in the forest does it follow the long-leaf pine as that tree is removed; and on the limited areas of old fields where it has appeared spontaneously, it seems unable to attain a large size or perfect development, the boles being short and crowded with limbs, the crowns large and spreading, the wood in the standing tree, even the sapwood, often evincing at an early age signs of decay. These are, in fact par excellence the long-leaf pine lands. No other tree for timber use is capable of attaining even a moderate development on this soil. The least exacting of the larger forest trees of the State, both in regard to soil-moisture and fertility, it is able to secure by means of its deep-seated taproot, which often penetrates the layers of sand to a depth of ten or twelve feet, the mineral elements necessary for its development, and reach on the most barren soils a height of 50 to 70 feet and a diameter of 14 to 16 inches. On the pauperized soils of the barrens lying near the sounds, the pine is unable to become more than a middle-sized tree 50 to 60 feet in height with a diameter of about 16 inches; on the deep and poor sands of Wayne, the northern part of Bladen, and portions of Sampson counties the conditions of development are similar to or only a little better than those prevailing near the coast, and continue so to the westward through Cumberland, Harnett and Richmond counties, until in Moore and Montgomery counties the loose sands become confluent with the late drifts derived from the sandstones containing clayey particles and a loamy subsoil, where a better growth can be secured. But on many of the smaller areas of sandy soils, where the taproot of the tree is able to penetrate the sand and reach a stiffer subsoil, the tree reaches

a larger size, a height of 70 to 90 feet and a diameter of 16 to 20 inches.

LEVEL PINE WOODLAND.

The surface of these lands, (also see page 161), is very nearly level, slightly rolling, or sloping toward the streams; the soils loose, or moderately compact loams, or sandy loams with somewhat firmer yellow or gray, loamy or stiff loamy subsoils; mostly fine-grained, moist or fresh but well-drained. As they become more moist and more loamy the loblolly pine occupies them, especially over the large areas to the north of the Tar river.

The larger areas on which the long-leaf pine is yet standing are in Edgecombe, Johnson and Wilson counties; the basin of the Northeast Cape Fear river from the southern part of Wayne county southward; large areas in the southern parts of Bladen and Robeson counties and smaller areas in Brunswick and Columbus Counties.

As has been stated, the long-leaf pine formerly occupied the greater portion of these lands to the exclusion of almost every other tree, but as the mature trees of this species were removed or died they have been rapidly replaced by the loblolly pine and, in most places to the north of the Neuse river, and in many places to the south, this substitution has been entirely effected.

The other trees which grow on these loams with the pines are the post oak, the Spanish oak and the black oak, and small hickories and dogwood.

CONDITION OF THE FORESTS OF THE LEVEL PINE WOODLAND.

Where pasturage has not suppressed the broad-leaf element, the forests of long-leaf pine on the moist loams also resemble a two-storied high forest. The upper story is a compact growth of pine, 100 to 125 feet in height; the the lower is of broad-leaf trees: post oak, Spanish oak, and black oak, small hickories and dogwood, reaching an average height of not more than 40 feet. In few localities is this condition now realized. The cover of pine has been broken by frequent windfalls and culling; in many places browsing cattle have suppressed the broad-leaf trees, or

they have been killed by fires. The loblolly pine, resisting successfully the fires and uninjured by cattle, has colonized either by solitary specimens or more frequently by groups of a few trees which have already reached maturity, or by thickets of younger ones, wherever openings in the cover above enabled it to secure a foothold. In sections long-settled, where the long-leaf pine has been culled, and in long-abandoned turpentine orchards the loblolly has replaced a great part of the long-leaf pine. The mature loblolly pines nearly equal in height the long-leaf pine and form a part of the cover, beneath which groups of young trees of the former species can be seen in all stages of development wherever, there is sufficient light to permit their growth. Nowhere except in the limited districts protected from fire and cattle, is there any young growth of the long-leaf pine. This tree, once dominant over such an extensive area, is surely failing to reproduce itself, and it is fortunate that a tree as valuable as the loblolly pine is supplanting it on these soils. The greater part of the compact loblolly growth to the south of the Tar river has in this manner gradually extended by occupying the lands from which the progeny of its closest competitor has been thus excluded by the influence of human agencies.

To the causes which have checked the growth of the long-leaf pine on the pine barrens, fires, hogs and infrequent seeding, there must be added another agency which has aided in suppressing it on the level loamy soils—the struggle with contesting species. As the cover in the long-leaf pine growth has been broken, either by trees being removed in lumbering or windfalls, seed from the loblolly pines in the swamps and along the streams have been blown in, this pine seeding more regularly than the long-leaf, and its seedlings have taken possession, the young plant not being destroyed by hogs, and by their rapid growth soon getting too large to be easily damaged by fires. Long-leaf pines, which after a time might have succeeded in getting a start, have thus been crowded out by being overshaded by the more rapid-growing loblolly pine. Under existing conditions it is impossible for the long-leaf pine to ever again succeed naturally in forming a growth

on the lands which the loblolly pine has thus possessed. The shade of the loblolly pine with that formed by the accompanying undergrowth of broad-leaf trees is too deep for the growth of the long-leaf pine seedling beneath them, even where there are long-leaf pines standing near that might produce the necessary seed.

SUPPLY AND UTILIZATION OF LONG-LEAF PINE.

The larger bodies of merchantable long-leaf pine lie in Bladen, Robeson, Cumberland, Moore, and Montgomery counties, the last being within the transitional region. There are smaller bodies in Sampson, Brunswick, Columbus, and Harnett counties. Nearly all of this has been tapped for turpentine. The total amount standing is estimated to be less than 3,000,000,000 feet, board measure, distributed so as to yield on pine lands an average cut of less than 3,000 feet, board measure, to the acre.

The greater part of the long-leaf pine timber is converted into lumber. Wilmington, the chief seat of the manufactnre of long-leaf pine lumber in North Carolina, is now supplied by rafts floated down the Northeast and Cape Fear rivers. The manufactured products go to coastwise ports and the West India Islands. The total shipments of long-leaf pine lumber from this port for 1896, amounted to about 20,000,000 feet, board measure.

The most active lumber operations in the interior are at Aberdeen, Troy Junction, and near Carthage. These mills not being on large water-courses obtain their timber by means of small railways which penetrate the unlumbered forest, and on which logs are brought in and delivered at the mills.

Logs of great length are easily handled, and a large part of the timber gotten out is of large dimensions for trestleing, framing, and other exceptional uses.

All railways passing through the long-leaf pine region use ties of this pine exclusively; and besides, such ties are used to a considerable extent on other parts of these lines not lying within the distribution of the long-leaf pine.

An explanation of the method of extracting resin from the long-

leaf pine, and the manufacture of resinous products is to be found in Bul. 5 of the N. C. Geological Survey publications, 1894.

TREATMENT REQUIRED BY THE LONG-LEAF PINE FORESTS.

On such loamy soils as are suitable for the growth of the loblolly pine, and which it now occupies in a great part, it would probably be more advantageous to secure in regeneration a pure growth of that species; or, where the loblolly has only lately begun to colonize, to offer it by protecting from fires, full facilities for securing a thick stand as the remaining long-leaf pine is removed.

The area of unlumbered long-leaf pine lands in this State is now of small extent and is the seat of active lumbering operations. The growth of pine is so open (the density in only a few places being over three-fourths of the possibility), that if protected from fire and hogs until after lumbered, there would be sufficient light for a young crop to have secured a start beneath the old pines. In localities in the transitional counties, where there is a heavy underwood of small broad-leaf trees, chiefly post oak, Spanish oak, and white oak, openings would have to be made in their cover in order to afford the young pines sufficient light for development. In many places where the pine has been regularly lumbered or culled for a great many years there is a like thick growth of small broad-leaf trees beneath the remaining pines, and here too the cover would have to be thinned in order to give the young pines the necessary light. In most places there are still sufficient mature pines standing, if left uninjured, to seed the ground after two or more seed-years, if the seedlings are protected. Where there are now no seed-bearing pines a crop would have to be artificially introduced by either sowing the seed or setting out young plants. As seed in a seed-year could be cheaply secured, and the young plants if set out would also require protection, it would undoubtedly be more economical to introduce by seeding. The first and absolute prerequisite before any attempt can be made to improve the condition of the long leaf pine forests is entire exclusion of cattle and hogs, and complete protection from fire. Laws enforcing the confinement of live stock will in a great measure secure

immunity from the first evil and will materially tend to mitigate the second, as the majority of the fires which sweep across the barrens with such destruction are purposely set to remove dried grass and herbage in the spring, and afford cattle the tender, fresh shoots of the year for pasturage.

Especially might much benefit accrue to these districts by the reenactment of special fire-laws for the pine barren districts, affixing more severe penalties for their violation; establishing for their execution an administrative corps of wardens and subordinate officers, with power to summon citizens in case of fires to assist in suppressing them, to inquire into their origin, and to bring suits in the courts against offenders and violators of the laws. The present fire-law is unsatisfactory in offering no adequate means for investigation into the origin of fires, so that it is seldom or never that offenders come within its bounds.

The long-leaf pine can be reproduced only from seed, and is adapted only for pure growth in a high forest with a rotation of from 80 to 120 or more years. As the tree reaches a smaller size and attains a less age on the highly silicious soils of the pine barrens it would be more profitable to use the longer periods of rotation, for the production of larger-sized timber, only on the better class of soils. It is more impatient of the shade than any other of the forest trees, the young seedling, even, requiring direct sunlight and enduring only a moderate shade, and the trees when once stunted by over-shading, or too much compression, never recover their normal vigor.

The group system of natural regeneration certainly seems to assure the successful starting of a new crop with a greater probability of success than any other. By this system groups of trees of considerable extent are removed at intervals through the forest, the areas from which they are removed being cut clean, and regeneration taking place by seeding from the adjoining trees. The young seedlings cannot be overshaded by the enlargement of the crowns of still-standing trees as is apt to be the case in selection cutting, and a thick stand, if the group is not of too great extent, more than two hundred to three hundred yards wide, insures sufficient lateral shade during the height-growth stage to

cause the formation of clear boles. Dwarfed and defective trees passed over in lumbering may be left until after a stand is secured, as seed from them will materially aid in obtaining an even distribution of the young crop; but they should be removed as soon as regeneration is assured.

Seed for planting should be gathered in autumn, between the middle of October and the early part of November, care being taken to keep them dry until sown. If the weather is at all moist and warm, planting should take place at once. This will enable the seed to germinate and root before winter. Otherwise they should be kept dry until early spring and planted not later than the first of April.

Only slight preparation of the soil is needed for planting. All broad-leaf trees should be removed, and a plowing to destroy the turf lessens the danger of the young pines being choked by the grass. From sowings carried on at Bladenboro as experiments, it would seem to take about five pounds of seed to the acre, there being about 10,000 seed to the pound.

LOBLOLLY PINE WOODLAND.

The area in which the loblolly pine is the dominant economic tree includes the greater part of the uplands north of the Tar river; most of the area lying between the Tar and Neuse rivers, except the uplands of Edgecombe, Wilson and Nash counties which are occupied conjointly by the long-leaf and loblolly pines; the basin of the Northeast river in Duplin and Pender counties; the uplands of Jones and Lenoir counties and a great portion of the uplands of Carteret, Onslow and Brunswick counties; much of Columbus and Robeson; the southeastern corner of Richmond; the eastern part of Anson and smaller areas in Sampson and Bladen counties.

The forests of this pine are chiefly confined to the level pine woodland with loamy or stiff loamy soils as were described in the growth of the long-leaf pine in the level pine woodland (p. 156).

To the north of the Neuse river, the loblolly pine forms a pure forest over the larger portion of the area, as it also does in a large portion of the coastal counties of Carteret, Onslow and Pender,

on the extensive flats of the Lumber river and its tributaries in Robeson county, and on the loose moist sands of the southeastern part of Anson county. Over the rest of the area the forests are more broken, consisting of small groves in old fields, or contain both the long-leaf and the loblolly pines.

CONDITION OF THE FORESTS.

Where unlumbered, the forests of loblolly pine are compact, with a continuous cover, the forest floor being good and with a moderately deep humus. On the best soils the trees attain a height of 90 to 100 feet, with trunks of 40 to 50 feet free from limbs. On poorer soils, especially where they have appeared spontaneously in abandoned fields, which are often on the lighter lands from the greater ease with which tilled, the trees are much smaller, not averaging over 70 or 80 feet in height. They have, however, proportionally larger diameters than taller trees and usually shorter boles, the growth, when young, having been so open that the trunks have not cleared themselves from limbs.

This is due to a greater number of the trees being suppressed, more light being necessary for growth on the poorer soils. The loblolly pine generally forms an upper story of pure growth, beneath which when the pine cover is dense there is a lower story of dogwood, post oak, and other small shade-enduring trees; or when the pine cover is open, as is frequently the case, there is a slightly subordinate growth of Spanish oak, black oak, and post oak, small hickory, and sometimes black gum and other trees. There is often a considerable amount of young growth of broad-leaf shade-bearing species, post oak, dogwood, black gum, and sometimes black oak and Spanish oak, which survive for a longer or shorter time beneath the shade of the other trees, the dogwood and post oak on the best soils even reaching maturity. Young pines, however, are wanting; and on the poorer soils broad-leaf tree seedlings only stand the shade, if at all, for a short time.

Where the forests of loblolly pine have been lumbered the pine shows for a few years no signs of succeeding itself, as there are no young pine seedlings beneath the shade of the mature pines. Self-sown seed, however, from neighboring trees or from under-

sized ones left in lumbering, even small trees seeding with remarkable fecundity and regularity, soon produce a vigorous stand of young pines in all open places and also beneath the light shade of the broad-leaf trees which often grow beneath the mature pines. This young stand rapidly pushes upward through the thin canopy to secure the light. As the oak flats are approached, with their more compact and taller-growing broad-leaf trees, it becomes more difficult after lumbering for the loblolly pine to replace itself. The rivalry between it and the competing broad-leaf trees is closer and more in favor of the shade-bearing broad-leaf element as the cover is less broken, until, on the ever-moist margins of the loamy-soiled swamps, and particularly where alluvial, the pine forms only a small proportion of the entire growth. It attains, however, in such situations its perfection of individual development. On the other hand, as the drier soils are approached there is less struggle between the loblolly pine and the broad-leaf trees; but as soon as the porous, loose, sandy soils of the pine barrens are reached, the loblolly pine with its delicate, rather superficial root-system is unable during the seedling stage to supply by its roots the water passed off through its leaves by transpiration and it succumbs during the first season.

MERCHANTABLE LOBLOLLY PINE TIMBER.

The merchantable timber had been more largely removed in the eastern counties where the numerous waterways greatly expedited exploitation as well as facilitated shipment of the manufactured products. In the counties lying north of the Roanoke river most of the loblolly pine suitable for saw logs has been cut; only small bodies attached to farms, or situated at a distance from transportation facilities yet remain. Great quantities of timber have been cut during the past twenty years for the local mills, the largest of which are located at Elizabeth City; and even larger quantities have been exported by railways and towed in rafts to mills in the vicinity of Norfolk, Va. Timber for the mills at Elizabeth City is now obtained from the forests contiguous to the Chowan and Roanoke rivers and from the counties lying on the southern side of Albemarle sound. There are still large amounts of pine tim-

ber standing in Dare and Hyde counties. The forests of Beaufort, Washington and Martin counties have, however, been nearly exhausted. In Pitt, Edgecombe, and Green counties exploitation is well advanced in the loblolly pine forests near the railways and water courses, while the greater part of the timber has been removed from Pamlico and Carteret counties. The unlumbered pine lands of Beaufort county lie in the northeastern part of the county; those of Craven in the southwestern part. Bordering the swamps in Duplin, Onslow and Pender counties are large unlumbered areas of loblolly pine growth, chiefly where this pine has superseded the long-leaf pine; and in Brunswick, Columbus, Robeson and Bladen counties, along Brown and Green marshes and the flats of Lumber river and its tributaries, are still large quantities of merchantable timber. There are smaller bodies of timber, though scarcely more than is sufficient for local use, in Wilson, Nash, Johnson, and the eastern parts of Wake and Anson counties.

FOREST INDUSTRIES.

The loblolly pine is tapped for turpentine only to an inconsiderable extent, but the lumber industries of all of the towns to the north of the Neuse river and of most of the sea-board towns to the south of it, are entirely dependent on this pine for their logs. The chief seats of the manufacture of loblolly pine lumber are Newbern, Washington, Elizabeth City, Edenton, Plymouth and Wilmington. The annual cut of logs amounts to about 560,000,000 feet, boad measure, less than two-thirds of which is manufactured in this State.

The loblolly pine is not used for railyway ties, or sleepers of any sort placed next to the earth. Railway ties for local use are made from the post oak growing beneath the pine. The dogwood is converted into shuttle blocks. No use is made of the small red oaks and other small trees which constitute the remainder of the forest.

FOREST PROTECTION.

The loblolly pine requires little protection compared with the long-leaf pine. The seed is small and is not seriously destroyed

by animals or in other ways. It falls during the late autumn and winter and sprouts during the following spring and by the end of the first season the seedlings have reached an average height of about seven inches. After that they grow at a rate of about eighteen inches a year for seven years, so that specimens four or five years old are too high to have any but the lower branches scorched by a fire consuming only the leaves and herbage. The thick bark, too, is a great protection to even small trees. Since they grow on moister soils and form a deeper shade than the long-leaf pine which prevents the growing of grass there is less danger from fires. Not being boxed or worked for turpentine the mature trees are less apt to be destroyed by fires.

Where growing on drier soils the growth of the loblolly pine is not so rapid later in life as in the early years and the scars left in the natural shedding of the limbs do not so quickly heal over, many of the trees being affected by fungus diseases which gain access through such openings.

REPRODUCTION OF LOBLOLLY PINE FORESTS.

In old fields and clearings within the area of the distribution of the loblolly pine a spontaneous growth of loblolly pine quickly appears, the light, winged seed being dispersed by the wind for a considerable distance, sometimes hundreds of yards, from the seed-bearing trees. The production of seed begins at an early age with isolated specimens, sometimes, when they are under ten years old, but later with those whose crowns do not receive full sunlight, and continues uninterrupted for a great many years. There is seldom a year when some trees in a locality do not mature cones, since the trees grow under such diverse conditions of soils and moisture. The cones, which require two seasons to develop, open and the seed are distributed during the autumn and winter after they have ripened, some remaining unopened until the succeeding spring. The seed retain their germinative power for several years, but usually germinate the first spring after falling to the ground or after being planted.

SYLVICULTURAL TREATMENT OF THE LOBLOLLY PINE.

The selection system of cutting, culling, was formerly much

practiced in the loblolly pine woods when the demand was almost entirely for pieces of timber of exceptionally large dimensions for special uses. By this method of cutting the largest specimens only were removed and the smaller allowed to continue their growth uninterruped. This was before kiln dried loblolly pine lumber became a feature on the lumber market and stocks of all sizes of this pine came into general demand for lumber purposes. Now clear cutting is the rule in lumbering, though much to the detriment of the forest.

In spite of the naturally abundant reproductive powers of the loblolly pine, much can be done during and subsequent to lumbering to facilitate regeneration and secure a thick stand of young pines. With clear cuttings, frequent seed-bearing trees should be left to insure a thorough and uniform seeding of the area at as early a time as posssible. It is absolutely necessary to protect recently lumbered lands from fires, as in the event of one while the ground is encumbered with the tops of the felled trees, all of the young pines will be destroyed. Cattle do but little damage to young loblolly pines.

Existing woods of compact young loblolly pines, in which the trees have reached a height of 35 to 40 feet, could probably be thinned by having the suppressed and subordinate trees removed, to the great benefit of those remaining, affording more light to the crowns and stimulating rapid enlargement of the trunks. Where dense growth is left to natural thinnings, the subordinate groups, the crowns enduring a considerable compression, will interfere for some years with the larger and more vigorous specimens which are ultimately to survive. By securing thick stands, however, during the early stages of development and thinning at the right times, chiefly when the period of most rapid height-growth has passed, the accretion secured within a given time can be considerably increased above what it would be if the wood were left to natural suppression and a prolonged struggle between trees, only a small proportion of which are ultimately to survive. At certain stages of development, however, the thick stands and the struggle between the trees to secure the light is necessary to cause the rapid pushing upward of the crowns and the formation of clean shafts.

In many places where small but vigorous-growing broad-leaf species have succeeded after lumbering in securing possession of loblolly pine lands, it will be found necessary to break their cover in order to permit the pine, unable to endure a heavy shade, to obtain a foothold. On some areas not a sufficient number of seed-bearing pines were left to thickly seed the area even in several years, during which time the broad-leaf trees thicken up to such an extent as to exclude the pine altogether. Where the pines do come up in such situation they make rapid height-growth and soon overtop the broad-leaf trees.

Such conditions as this are only encountered on the better class of soils. In such places either enough pines must be left to insure thick and immediate seeding, or the broad-leaf trees must be removed or thinned simultaneously with, or just after, the cutting of the pines. A portion of the underwood, the post oak and dog-wood can be removed without any extra cost, the former being in demand for railway ties and the latter for shuttle blocks, etc. In many places where the underwood is not salable, its thinning or removal in part will be a matter of necessity in order to secure successful reproduction of the pine.

An inspection of loblolly pine lands which were closely lumbered 6 to 12 years ago fully shows that regeneration is imperfect and decidedly irregular, many places of considerable extent being entirely without a young growth of pine.

As is the case with the other pines, the loblolly can be reproduced only by means of seed. It is adapted for pure growth in a high forest with a rotation of 50 to 120 years, according to the dimensions of the timber desired, and the quality of the soils; or it can be grown on the best grades of moist or damp loams, in mixed woods with the large broad-leaf species, under a more lengthy rotation for the production of large-sized timbers.

The trees, especially when young, endure some shade, and during the early stages of development the crowns are capable of withstanding considerable compression, but if overshaded for a long time are unable, when light is afforded them, to regain their vigor. Its easy reproduction by means of the light seed renders it especially adapted to clear cuttings, when regeneration can be secured from adjoining woods. That is, it is adapted to the group

system of natural regeneration with large-sized groups, or the strip system, with groups or strips not over three hundred to four hundred yards wide. This is the method of regeneration now roughly relied on over a large portion of the eastern counties, though the seed from under-sized and defective trees, left on the lumbered area, materially assist. To make certain of regeneration the strips cleared at one time should not have a greater width than four hundred yards.

For planting very little preparation of the soil is required. Thin woods of broad-leaf trees can have loblolly pine planted with them if their cover is sufficiently open to admit of the growth of the pine, wherever the humus is not too deep, without any more preparation of the soil than turning over the humus. Waste places that are not naturally seeded could advantageously be plowed and artificially planted. Seeding can be done in early spring, the seed being covered by harrowing with brush, but should not be covered deeper than ½ inch. The greater part, if not all, of the seed will germinate the same year in which planted, usually in about four weeks. About four pounds of seed are required to sow an acre. There are about 25,000 seed to the pound. The young plants must be carefully protected from fires.

TRANSITIONAL FORESTS.

The transitional forests, lying along the western border of the coastal plain region, are formed by the overlapping of the coniferous forest of the pine belt and the broad-leaf forests of the Piedmont plateau region, so that oaks and hickories with the long-leaf pine form the greater part of the growth. These forests are best developed in the middle and southern parts of Nash county, the eastern part of Wake, and the western part of Montgomery. To the north of Nash county, in Northampton and Halifax counties, it is only occasionally along crests covered with sandy drift that the forests are typically developed; elsewhere, on the more loamy soils, the broad-leaf element exists without the long-leaf pine, and is associated with the short-leaf and loblolly pines. In southeastern Chatham and southeastern Randolph counties the long-leaf pine also occasionally occurs along sandy or gravelly crests, but

the area occupied by it is comparatively small. The transitional forest is best developed in the western part of Montgomery county, where it forms a belt three to six miles in width. The trees most abundantly associated with the long-leaf pine are the black-jack oak, post oak, Spanish oak, and white oak, and white hickory; these form a low growth, 30 to 50 feet in height, and are overtopped by the long-leaf pine, which is 60 to 90 feet in height. In some localities the pine forms as much as one-fourth of the entire growth; usually, however, much less.

The loblolly pine which is associated with the broad-leaf trees in these transitional counties, is very largely second growth.

The long-leaf pine has been extensively culled in Wake and Nash counties, and but little merchantable timber of that species remains; in Montgomery county, however, the forests are still intact.

The long-leaf pine is failing to reproduce itself in these forests for the same reasons that were given for its scanty reproduction in its competition with the loblolly pine; here, the competition is with broad-leaf species.

All the transitional forests lie within the Piedmont plateau region, the forest soils being derived for the most part from crystalline rocks, and are more fertile or at least better suited for tree growth than most of the soils in the coastal plain on which the long-leaf pine is found growing.

FORESTS OF THE LOWLANDS OF THE COASTAL PLAIN.

These forests occur on lands which are swampy or inundated during at least a part of the growing season, and are naturally separable into four divisions which differ in the character of the dominant economic growth:

(1.) In which numerous broad-leaf trees, chiefly oaks, constitute the greater portion of the growth—the oak flats.

(2.) In which gums and cypress constitute the chief growth—the gum and cypress swamps.

(3.) In which the white cedar occurs—the white cedar swamps.

(4.) In which the pond pine forms the greater portion of the growth or is the largest tree—pond pine pocosins.

OAK FLATS.

The oak flats border most of the gum and cypress swamps, lying between the gum and cypress swamps and the level pine lands. They constitute about one-fourth of the swamp area, or 1,000 square miles. The soils are damp or moist usually deep loams, or more often sandy loams, generally inundated during spring, with a good humus and a fair intermixture of vegetable matter in the top-soil.

Their growth is entirely of broad-leaf trees, in places with occasional loblolly pines disseminated among them, but the white and water oaks are characteristic. Water and willow oaks skirt the flats. Swamp chestnut oak and overcup oak, Spanish oak, and occasional white oaks form a great part of the growth of the interior; with them, elms, red maple, cottonwood, and more or less sweet gum and water gum. These form an upper story 80 to 100 feet in height, and of considerable density; beneath them are many small trees, post oak, hornbeam, and haws.

Where not suppressed by browsing cattle, or the shade is not too dense, young seedlings of most of the trees are represented. All of the trees endure a light shade in youth; the willow and water oaks least, the white and overcup oaks the deepest and for the longest period. In most localities pasturage is regularly practiced, this woodland being esteemed the best grazing-ground for cattle during the spring and summer, and the young growth of tender broad-leaf species is systematically suppressed. Pine and the more vigorously sprouting and rapidly growing species and those seeding most abundantly—cottonwood, water oak and willow oak—largely replace windfalls and culled specimens. The seed of the swamp chestnut oak, overcup and white oaks are largely destroyed by hogs; the seed of the other oaks to a less extent.

There is so little undergrowth, and these woods are so damp, that fires rarely pass through the flats or do any serious damage. Much of the best white oak, the several species, and Spanish oak,

has been culled for making staves or for large-sized timber—tun timber—for shipbuilding, water and willow oaks or pine having replaced them. The soils, being fertile, extensive areas have been drained and put under cultivation. Where such areas are abandoned the loblolly pine with sweet gum, and if seed-bearing trees be very near, water and willow and Spanish oaks establish themselves; the pines first and most abundantly, the others later and in less numbers. If not thoroughly drained, the oaks will in time supersede the pine or a portion of it.

Where the soil of the oak flats becomes at all peaty yellow poplar occurs, but only occasional trees among the others. It is most frequent in the series of counties facing the sounds.

In a few places in the vicinity of the coast, or near large bodies of water where the air is especially humid, there is a considerable intermixture of beech with the oaks.

In connection with the oak flats may be considered the greater part of the alluvial bottom lands bordering the larger streams that have their headwaters beyond the coastal plain region. These fluvial soils are silty, a mixture of the finest clayey and silicious particles, with a varying proportion of decomposing vegetable matter intermixed. The silt becomes finer and the soils more compact as the coast is neared. On the more elevated parts of these bottoms where the periodic overflow is neither too frequent, or the rise of the water too deep, there is a mixed growth of broad-leaf trees. Variations in the kind of trees occur according to the depth and frequency of the overflow.

Where the soils are drier the water and willow oaks, white oak and the Spanish oak with shagbark hickory form most of the woods; where wetter, ash, cottonwood, and hackberry are largely intermixed, these being replaced on the wettest soils by sweet gum, water gum and tupelo with cypress and some cottonwood and swamp ash.

The white oak and ash have been extensively culled from these swamps, and merchantable cypress has been largely removed.

These woods, when oaks predominate in them, are practically under the same conditions and require about the same system of management as will be indicated for the oak flats. The white

and Spanish oak are to be favored at the expense of the other less valuable kinds of trees, which if left alone are apt to take their place. On the alluvial lands the species usually succeeding the oaks are the light-seeded sweet gum, cottonwood, sycamore, and, to a less extent, hackberry and loblolly pine.

MERCHANTABLE TIMBER ON THE OAK FLATS.

The largest areas from which the white oak has not been severely culled lie in Bladen, Onslow, Jones and Pamlico counties. They will cut to the acre from 40 to 60 cords of mixed hardwoods. Where culling of white oak has long been practiced water oaks have gradually replaced them, in a great measure at least.

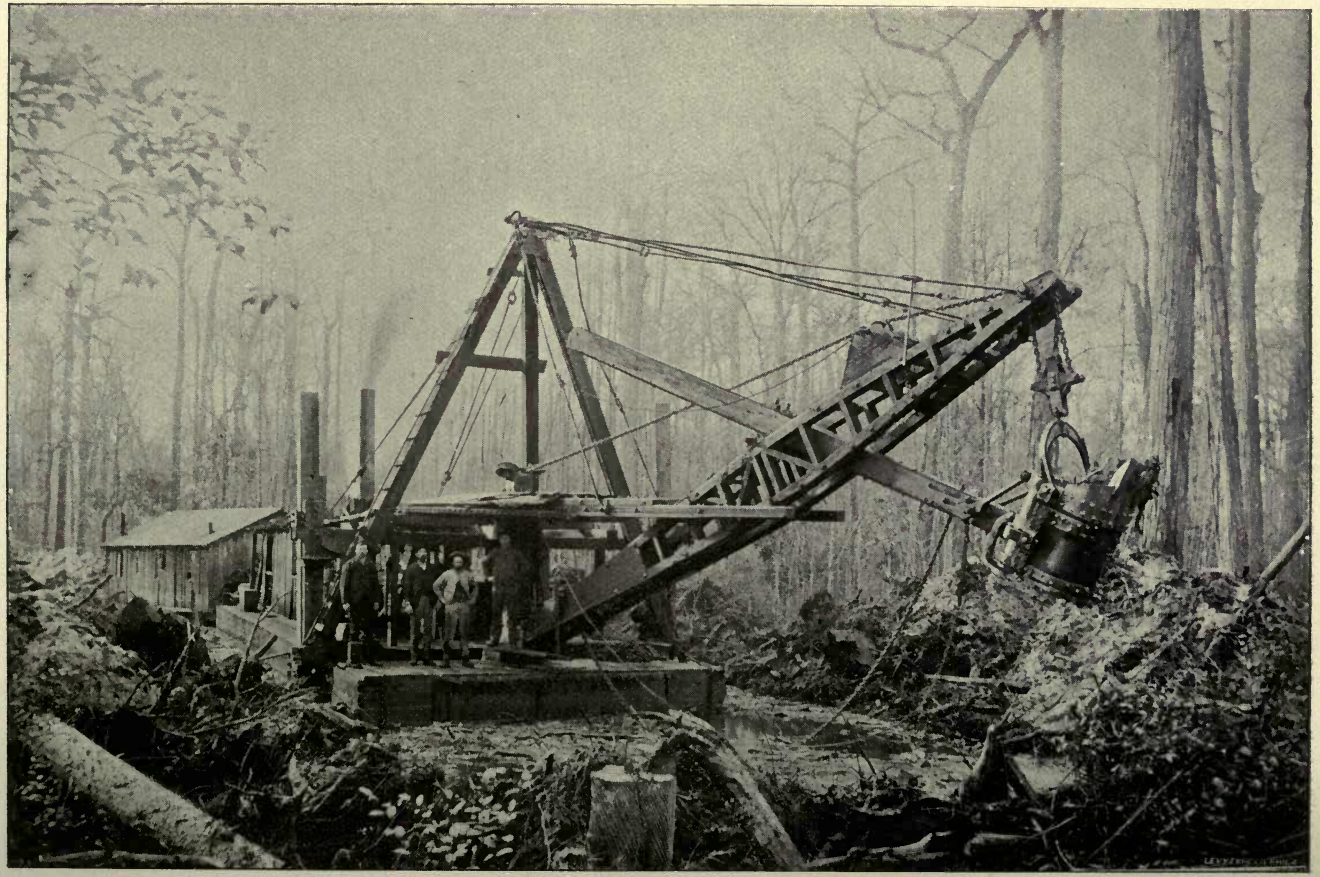
These forests yield excellent white oak timber and some "red" oak (Spanish oak) of large dimensions, and suitable for milling purposes; yellow poplar and cottonwood for paper-stock; a limited amount of red maple, and large quantities of white oak railway ties.

SYLVICULTURAL TREATMENT.

The seed of such species as it is desirable to reproduce should be protected from hogs, and cattle should be excluded from all young growth, until it is too large for them to injure.

The most valuable trees occurring on the oak flats are the several species of white oak and the Spanish oak, and forest management should have for its object the increasing of the proportion of these, and preventing the water oaks and other less valuable species from supplanting them.

On large areas where indiscriminate culling has to a great extent removed the species of white oak, less valuable trees have already followed, and but little can be done in the way of natural regeneration to raise the standard. Artificial re-introduction of the white oaks is necessary. This can be accomplished by thinning the existing wood of the least desirable species or by removing decrepit specimens, and underplanting with acorns, preferably with those of the swamp chestnut oak, since in the latitude of this State that is the most vigorous-growing species and reaches the largest size on such soils. Or, the swamp chestnut oak or



DREDGE CUTTING A LOGGING CANAL IN A CYPRESS SWAMP COLUMBUS COUNTY

other desired species, can be introduced gradually beneath such breaks in the cover as are occasioned from time to time by windfalls or by culling.

If the underplanting is done by seeding, and where acorns are abundant or can be cheaply obtained this is the preferable way, being less expensive than raising young plants in nursery rows and then transplanting, the acorns should be gathered in the autumn, as soon as they have fallen ; if they are to be kept for spring planting they should be deeply packed in fresh sand on the north side of a barn or some other cool situation. If the acorns of the chestnut oak are allowed to lie on the ground too long after falling, particularly if the weather is moist and warm, a great part of them will have begun to sprout and then cannot well be kept over winter. The acorns of this oak are more difficult to keep over winter than those of any other, and they retain their germinative power for the shortest time. For these reasons it may be advisable to sow in the autumn, though some of the acorns may be carried off by squirrels and mice, and there is a possibility that such as do not sprout and take root in the autumn, as most of them, however. will, may be carried off by high-water.

The oak flats and the narrow alluvial bottoms are the only lands in the coastal plain region which are capable of producing a growth of large-sized broad-leaf trees, and for this reason they assume a greater importance than their limited area would otherwise seem to justify. Whatever in the way of yellow poplar or oak timber suitable for saw-logs, or of hickory for mechanical purposes, is to be grown in the coastal plain region must come either from the oak flats or the alluvial bottoms.

THE GUM AND CYPRESS SWAMPS.

The gum and cypress occupy the deepest parts of nearly all the swamps which have a sufficiently porous soil to permit the penetration of the deeply seated cypress roots and which are not subject to drying out in the late summer ; and even though the surface may be very dry in dry seasons, if the subsoil be well watered and porous, these trees may still flourish. (Plate XXI.)

They seem to be rather indifferent to the quality of the soil, attaining a large size and comparative thick growth on even the sandy soils, provided they are well watered. The presence of a deep humus which has been uninjured by fire has undoubtedly much influence.

On the sedimentary alluvial soils the growth is from 110 to 125 feet in height, and it is somewhat less on sandy soil.

The body of the wood is formed of sweet gum, water gum and tupelo, with these more or less cypress, which however seldom constitutes as much as one-fourth of the entire growth. Beneath these are small water ash, and young trees of species represented in the dominant growth, in all stages of development. The trees are all shade-enduring in their youth and, probably with the exception of the water gum, all shade-demanding in the earliest seedling stages.

It is not often that fires do damage to these swamps, as through the winter and spring they are too wet to burn; but sometimes in dry autumns the underwood is destroyed with great loss.

The injury inflicted by browsing cattle is slight.

MERCHANTABLE TIMBER OF GUM AND CYPRESS SWAMPS.

The supply of cypress suitable for making either board or shingles is nearly exhausted. In the Pamlico peninsula several large bodies are yet intact; scattered trees still stand along most of the larger streams: Roanoke, Tar, Neuse, Northeast and Cape Fear rivers; smaller bodies are yet to be found in many of the other swamps, such as those surrounding Lake Waccamaw, Big Swamp in Bladen county, and others.

Except in the few places where the forests have been unlumbered the cover is broken and irregular from the removal of the mature cypress. The thickets of water and sweet gums growing beneath them have rapidly pushed upward to take the place of the cypress on its removal.

While the timber of the cypress is of the most excellent quality, its natural powers of reproduction are so limited and the accretion of the trees after the height-growth is made is so slow that the outlook for extensive reproduction is far from encouraging.

Although the cypress does not discriminate in regard to mineral fertility of soil, it is so exacting in regard to moisture that the area which is really adapted for its best growth for timber is exceedingly limited. The trees growing on the margins of the swamps, and in swamps where the moisture is very unequally distributed through the growing season have a far larger proportion of sap than those in the deep swamps and are often seriously affected with hollows.

Although young cypress trees in all stages of development are to be seen scattered through the forests, their number, in comparison with the competing sweet and water gums is insignificant. Their height-growth, however, is rapid until the trunk begins the formation of the characteristic short, flattened, spreading crown. After the attainment of the height-growth, the diameter growth, the stage of most rapid accretion, is sufficiently rapid. The trees at this stage have a diameter of from 14 to 18 inches, and are from 80 to 100 years old, and are still largely sapwood. The diameter-growth after this becomes gradually less, until in some of the oldest and largest trees there are as many as thirty rings of annual growth to an inch of diameter. The length of time required to reproduce the forests which are now being utilized will not be less than 200 or 250 years, and many of the large trees in the existing forests are over 300 years old. For most of the purposes, too, for which the timber is used, that of the more rapid-growing white cedar is equally as well adapted. The area of such swamp land suitable for the growth of cypress is not far from 300,000 acres, while the area of gum swamp is over 1,200 square miles.

WHITE CEDAR OR JUNIPER SWAMPS.

The woodland in which the white cedar is the dominant tree occupies small shallow swamps, "bays"; or not infrequently there occur groups of a few trees disseminated through gum and cypress swamps, or more rarely in beech and yellow poplar flats where the soil and moisture-conditions become favorable for the development of the white cedar and less favorable for that of the larger broad-leaf trees.

The most extensive bodies of such swamp lie in the vicinity of the coast in the great Dismal Swamp; in the counties of Dare and Hyde; and the Pamlico peninsula, where the cedar occurs in small groups in a morass, the growth in which varies a great deal as the amount of moisture in the soil becomes greater or less. There are other large bays in Pamlico county, and on the flats surrounding and contiguous to Lake Waccamaw. Smaller bodies are scattered along the sandy bottoms of the Chowan river, and occupy small bays in Jones and Bladen counties, and the shallow flats bordering the clear-water streams, in Bladen, Cumberland, Richmond, Harnett and Moore counties. On the State's northern border white cedar occurs at an altitude of 100 feet above sea level; in Moore and Richmond counties, at twice that elevation. Its further distribution to the westward is checked by unfavorable soil-conditions. The total area of white cedar swamp does not exceed 200,000 acres.

The white cedar is confined to sandy or peaty soils. In the maritime counties it occurs chiefly on peaty soils, often underlaid by marls; in the more inland and southern counties it is found along the sandy beds of small streams or the contiguous sandy flats subject to frequent overflow; or it occupies small depressions in the sandy soils of the long-leaf pine forests forming the juniper bays. It shuns the heavy alluvial soils.

CONDITION OF UNLUMBERED WHITE CEDAR SWAMPS.

On the peaty soils of the best character, especially where lying above beds of loam or marl, white cedar is associated with yellow poplar, the gums and bays, wherever the amount of moisture and the undecomposed organic constituents become too great for the growth of the oaks. On somewhat better soils it forms dense clumps of nearly pure growth where openings occur in the cover of the dominant story of yellow poplars and gums. In the depressions in the pine barren sections in the white cedar or juniper bays it constitutes, with the white bay and the red bay, the greater portion of the growth, forming a dense wood 60 to 70 feet in height, the crowns of the trees closely interlocking above, their trunks thick, straight and slender; beneath them, and in their

deep shade, are almost impenetrable thickets of young trees and shrubs. The forest floor is a thick humus or is deeply bedded in sphagnum. On the sandy flats bordering the streams, trees of white cedar occur scattered in a rather open growth of small gums and bays, and reach a height of 30 to 50 feet and a diameter of 15 to 20 inches; the humus is thin and the undergrowth thickets of small bushes.

In most localities the cedar swamps have been exploited, or the removal of the cedar is now in progress. Except where yellow poplar forms a portion of the wood, the white cedar is the only valuable tree, and it alone has been removed, all specimens usually being removed that have a greater diameter than 8 inches at the stump. Where the greater part of trees are cedar, the cutting is nearly clean, and the few small trees that are left, having very slender stems, are snapped off by the first severe storm; where there are more broad-leaf trees present, these afford protection to the young growing-stock too small to cut. The bays and gums that are left make rapid growth after lumbering, and for some time retain undisputed possession; the extremely small white cedar seedlings beneath them, although at first making slow growth in the shade, finally re-assert themselves, make rapid height-growth and break through the cover above them, and struggle with the broad-leaf species for the light. If the swamps are burned, as is frequently the case after lumbering, and the burning is not so deeply in the soil as to injure the roots of the broad-leaf trees, they will sprout vigorously from stool and root; the fire-tender white cedar, however, will be entirely destroyed, and only after a great many years will it again be introduced by wind-sown seed. If the soil is peaty, and is very deeply burned, its ability for supporting a growth of white cedar may be entirely ruined.

Only a small proportion of the area of the cedar swamps has been deforested for agricultural uses, such areas being the best drained of the peaty soils with yellow poplar as a part of the growth, and such cleared lands lie chiefly in Dare and Pamlico counties and those counties which penetrate the Dismal Swamp. Agriculturally these lands are among the most productive in the State. A few other areas may in time be drained and reduced to

tillage, but most of the soil, both where peaty and sandy, is unsuited for agricultural purposes, and the permanency of the growth of white cedar on it should be accepted as an assured fact and protection and management bestowed on it accordingly.

Fires, in dry seasons, when the peaty soil or deep humus becomes thoroughly dry, sometimes spread from the pine lands, or from farms, to the white cedar swamps and inflict severe damage, destroying not only the young growth, but much of the old, and burning up the soil as well.

Extensive areas of unlumbered forests still exist in Dare and Tyrrell counties, and smaller in Gates, Jones, and Brunswick. Smaller bodies occur in Bladen, Cumberland, and Harnett counties, from which the largest specimens have been culled for telegraph and light posts.

TREATMENT OF WHITE CEDAR SWAMPS.

The white cedar is one of the most valuable trees growing in the coastal plain region. The demand for its timber, on account of its lightness and resistance to decay on exposure to moisture, is far in excess of the supply. Though exacting in regard to soil, its preferences are for such lands as are unsuited for agricultural uses. Its sylvicultural treatment is beset with no difficulties, and its rapid growth offers inducements of early returns to whoever produces it. Where culling can be practiced, and only the largest stocks removed, the largest yields of timber are secured, since the young trees which are too small for use can continue their growth uninterrupted, sheltered by specimens with firm trunks which can protect them from the wind. In only a few places, however, will economic considerations permit this, as the cost of cutting roadways, laying trams and making sound road-beds, which has to be undertaken to remove this timber, is so great that the cutting to the smallest size that can be utilized is often justifiable.

Where the soil is sufficiently wet, not so much shade is demanded by the very young plant to protect it from the sun; where drier, more shade is necessary.

As seed-bearing years are frequent, and the light, slightly winged seed are borne in abundance, modified forms of clean cutting can

be carried on which will allow regeneration beneath the shade of the parent trees. After the laying out of the system of roads, a preparatory cutting can be made in which most of the larger specimens can be removed, being selected as uniformly as possible so as to distribute the light below evenly. Then two, three or four years later all of the remaining trees which can possibly be utilized can be removed, waiting though until after there has been a sufficiently large yield of seed to produce a thick stand of seedlings in the light shade caused by the breaking of the cover of old trees. The young seedlings the second year after they have sprouted will be able to endure full sunlight.

There is no doubt but that the area of white cedar growth can be much extended by introducing it artificially in localities which have a suitable soil, but have a growth of bays and large gums, which by their somewhat superior growth have naturally been able to exclude the white cedar. The proportion of it can also be increased in situations where it already grows by removing competing species,—bays and gums, and permitting the cedar by natural seedings to take their place.

Artificial propagation must be by seed, and as has been suggested, must be carried on in the shade of some other tree to protect the young seedling from too rapid evaporation during the first summer and autumn while the root-system is as yet comparatively undeveloped, shallow, and insufficient to supply water as rapidly as it passed off by transpiration. The seed, which are borne in small berry-like cones, are very small and slightly winged. The cones should be gathered in the early autumn, before they have opened or fallen, and while the seed are yet in them, kept through the winter in a place where they will not dry out, and planted the next spring by sowing broadcast beneath the trees that are to serve as protection to the young plants.

THE POND PINE POCOSINS.

These, as the name implies, have the pond pine as the distinctive growth. With it are the white bay, red bay, and loblolly bay, and less frequently small black gums and loblolly pines.

During certain seasons of the year these pocosins are swamps

or semi-swamps. When they occupy the summits of the divides between watersheds, as is the case with some of the largest, they are poorly drained and often wet. They include two classes: (1) Those having a primarily pauperized soil of coarse sand, or of finer sand, silty, and more compact. (2) Those having an impervious stratum of clay, silt or hard-pan underlying the top-soil and preventing percolation of the water to underground streams or its exit by subsoil drainage. The latter may have soil rich in nutritive elements though eminently unproductive. During winter and spring such soils are saturated; during summer and autumn, from inability of subsoil moisture to rise to the surface through the impervious layer, they are exceedingly dry.

The largest areas of such swamp lie in Bladen, Craven, Jones, Pamlico, Tyrrell and Washington counties; while a considerable portion of the Dismal Swamp, in the northeastern corner of the State, has a soil and growth of this character.

The forest, even in the best condition, is exceedingly open and thin, there being an irregular growth of pine 40 to 60 feet in height, the mature trees averaging about 14 inches in diameter, and a denser underwood of small white bay, red bay and loblolly bay, almost impenetrable on account of the thicket of the gall-berry, huckleberry, and species of Andromeda and similar shrubs beneath them. Where the soil is of better quality, either more fertile, or because the impenetrable substratum is deeper beneath the surface, there is more pine, often a considerable part of it being loblolly, and the underwood is less dense. Where the soil is least fertile there is least pine and a denser thicket of shrubs.

Next to the long-leaf pine the pond pine is less exacting in regard to fertility of soil than the other pines, growing, in many places, on the soils which if dry the long-leaf pine would occupy. The young plants of the pond pine will endure a considerable shade for many years. When young specimens are accidentally broken, eaten off by cattle, or top-killed by fire, they sprout freely. During dry seasons conflagrations sometimes consume the shrubby underwood, destroying much of the timber. When the pines are thus burned out, the white bay puts forth abundant suckers, forming dense thickets, and the red bay numerous shoots;

the pine, however, in time returns. Although seed-years are frequent, the crop is usually small. The cones remain attached to the limbs for a long period, often retaining the seed for several seasons. The seed retains its germinative powers for many years and may sprout the spring of the first or second season after falling to the ground. As the trees do not grow in thick stands, they fail to clear their stocks until of a large size. Through the dead branches and knot-holes many rot-causing fungi find entrance. Many large trees are unsound from this cause.

This pine produces very little merchantable timber, though if fires are kept from destroying them the yield would not only be larger but of a better quality. In a few limited districts a considerable part of the saw-logs are from this species. It is chiefly of importance on account of the large areas in the State on which it occurs as the only timber tree.

FORESTS OF THE PIEDMONT PLATEAU REGION.

The differences in the character of the forests of the Piedmont plateau region are the results of the influence of variations in the quality of the soils, and in the altitude of the surface above the sea level. The precipitation is nearly the same in all sections of the region, and there is very little difference in the relative humidity between even extreme localities within its limits; so these factors exert only unimportant influence. The variations in elevation, too, are so gradual throughout the greater part of the region as to affect only slightly the composition of the forest, except when those of extreme distances are compared; but on the southeastern border, on the abrupt rise marking the transition to this region from the coastal plain, these forests contain certain species which are representative of the latter region, the distribution of some trees extending even much further to the westward; while other species characteristic of the sylva of the higher mountains penetrate from the northwest far to the eastward, but usually occur only around the spurs of the Blue Ridge or the isolated peaks situated beyond them in the Piedmont plateau. The forests of the eastern lowlands of

the Piedmont plateau contain the greater number of species that are representative of the sylva of the coastal plain.

The distribution of the economic forests, however, is determined largely by the character of the soils.

The forests of the lowlands are of relatively small extent and importance; while those of the uplands are extensive and yield nearly all the timber suitable for construction.

THE FORESTS OF THE PIEDMONT LOWLANDS.

The lowlands of the Piedmont plateau region instead of embracing broad swamps are confined to narrow borders of sedimentary origin along the streams. Their forest growth is composed entirely of broad-leaf species except in the eastern border counties, where occasional loblolly pines are found mixed with the hardwoods.

The lowland forests may be divided into (1) those in the hollows and bordering the smaller streams, where the soils are sandy loams containing a large proportion of organic constituents; and (2) those contiguous to the larger and more slowly flowing streams, which are bordered by flats having silty soils, containing more clayey ingredients and less vegetable matter than those of the bottoms of the smaller streams. These two classes of forests and soils, sharply defined where a small stream flows into a large one, gradually pass the one into the other in ascending the rivers.

The changes in the character of the growth along the larger streams take place gradually as the changes in the composition of the soils, there being usually, no abrupt transition in the kind of growth of different portions of the some swamp, as occurs in the swamps of the coastal plain region. Many species, abundant along the lower edge of the region, the southeastern, become less frequent as the streams are ascended; others, less common to the eastward, increase in number as the soils become more loamy and the Blue Ridge is approached.

The loamy alluvial lands contiguous to the smaller streams have in all parts of the region very nearly the same kind of growth: beech, red oak, and white oak, maples and yellow poplar, while with these are associated many smaller trees: the hop-hornbeam,

umbrella-tree and dogwood, which sometimes are sufficiently numerous beneath the deep shade of the more lofty trees to form a thin underwood. As these soils, however, become at all silty the sweet gum and black gum, overcup and swamp chestnut oaks, and other trees which are more representative of the forests along the larger streams gradually become conspicuous; supplanting first the beech and red oak, then the white oak and yellow poplar, and finally entirely taking their place.

The body of the forest on the silty or mud alluvium of the larger streams is generally formed of sweet gum and black gum, bitternut, overcup oak and swamp chestnut oak, sycamore and hackberry. Of these trees the black gum, bitternut and sycamore are uniformly distributed throughout, although nowhere abundant or forming a conspicuously large portion of the growth; they extend beyond the confines of the Piedmont plateau and enter into the composition of the forests of the mountain region. The elms, hackberry, and sweet gum, on the other hand, become smaller in size and less frequent to the westward, until on the table-land west of the Blue Ridge they become rare trees, occurring only in the basin of the French Broad river and along the larger streams to its southward. The overcup oak is found westward but little beyond the limits of the loblolly pine in Granville county, but in Anson county it makes a broad sweep to the west, and extends up the valley of the Yadkin river, as far as the eastern parts of Davie and the southern portions of Yadkin counties; while the swamp chestnut oak extends west to the Broad river in Cleveland county and north to Granville and Davie. To the eastward it is the red maple which is the characteristic maple, while the sugar maple occurs with it in cooler places as the altitude increases, extending down to about 500 feet above the sea level. With these trees in the eastern border counties occurs the loblolly pine; and very often as far to the west as Lincoln county the water and willow oaks are found; less frequently the Texas red oak, and in a few places the big shagbark hickory. On the extensive flats of the Neuse and its tributaries, and on other streams in this portion of the State, though to a less extent, the shagbark hickory becomes one of the most conspicuous and

abundant trees, while with it in a few localities is found the small shagbark.

Beneath the taller trees, no matter what kind, especially where the cover is somewhat open, are the hornbeam with the thorns and haws, and often papaw.

To the eastward a few broad flats occur, the soils of which remain moist or even wet, but are rarely inundated, and these are covered with a growth of water oak, overcup oak and willow oak, and fringed with white and black oaks. The broad flats of Little river in Union, Stanly and Anson counties, and those along some other streams in the same section of the State, are of this description.

All open banks where there is full sunlight are lined with river birch and black willow; and some flats which are subject to frequent and periodic overflow are covered with compact groves of willow or birch; or if the inundation is more prolonged, and this is particularly apt to be the case eastward, with thickets of small ash and elm.

Besides these lowlands may be added the mud or clay deposits in depressions on the crests of ridges, usually found in sections where the soils are shallow, often where slates are the country rock. They are very wet during rainy weather, and for some time afterwards, as there is little subsoil drainage; but during the summer and autumn become exceedingly dry. The growth on such deposits is usually entirely of willow oak, black-jack oak and more or less post oak.

Many of these bottoms with a loamy soil, particularly where the growth was the white oak and poplar, representing some of the most fertile land, have been cleared. Some, however, after being cleared, have been found untenable on account of the overflowing, and have been finally abandoned. Such lands are usually covered quickly by heavy thickets of birch, sycamore and elm, while maples and gums, whose seedlings grow well in a shade, soon appear beneath them.

Where lumbering has been going on along these bottoms or staves gotten out, the débris, which is carried off by the streams, often collects at shallow points so as to block the channel of the

stream, and back the water for some distance above, killing most of the mature trees which may be on the adjoining bottom, as well as a greater part of the young growth, by flooding their roots. Dense and fast-growing thickets of elm and ash, and rarely black gum, appear in such places, and continue unmixed until the bed of the swamp is sufficiently raised to allow other trees to grow.

The oaks on all of these bottoms show very little young growth, if the water oak to the eastward and the swamp chestnut oak in some localities be excepted. Where oaks and other trees have been culled, chiefly maples and sweet gums have taken their places, so that the promise of the bottom lands for the future is not bountiful, nor do they now contain any large supply of merchantable timber.

IMPROVEMENT OF THE FORESTS OF THE LOWLANDS.

The forests of the bottom lands have in nearly every instance been excessively damaged by constant pasturage. The white oaks have in consequence not reproduced as abundantly as other species whose foliage and seed are not so largely interfered with by stock. To the eastward and along the stiffer-soiled bottoms the overcup oak and swamp chestnut oak are the most worthy of extensive reproduction; to the westward and along the smaller streams where the soils are more loamy the white oak is more desirable. Protection must be accorded these in same way as was indicated in the case of the oak flats of the coastal plain region, and regeneration should be secured in the same way.

Abandoned fields and closely culled spaces on the wetter soils of the bottom lands are quickly sown in a mixed growth of light-seeded trees, chiefly birches, willows and sycamore, and among them soon appear ash and elms and other species demanding a light shade.

Sometimes, especially along fence rows, black walnuts appear, and these are worthy of protection. In open or thin places in the woods, on the drier bottoms, this tree could well be extensively introduced artificially. In the western and northern part of the Piedmont plateau it will reach a large size, but as with

other broad leaf trees, it must be kept in a thick stand until the height-growth has been nearly completed to secure clean stems.

FORESTS OF THE PIEDMONT UPLANDS.

The upland forests of the Piedmont plateau region are of broad-leaf species and pine, or of belts of broad-leaf trees with pine alternating with belts of broad-leaf trees without pine, there being no areas in the original forest, if some shallow granitic soils be possible exceptions, which produce a pure growth of either a broad-leaf or coniferous tree.

The sequence of belts, with and without pine, continues unchanged in this State to the northwestward as far as the eastern boundary of the mountain region in Surry, Wilkes, Caldwell, and Burke counties; and to the southwest, crossing the Blue Ridge, and with the difference between the pine and no-pine belts more accentuated from the effect of elevation, occurs to northern Georgia and eastern Tennessee.

This succession of forest belts, or the presence or absence of pine in the woods, depends on the variations in the character of the soil, as to texture, as well as in mineral constituents, and drainage. The belts of soil, following or coinciding with the geological terraines, lie, in general, northeast and southwest courses, though the interposition of dykes, particularly granite dykes, to the eastward, has produced more limited belts lying at various angles to these; and not infrequently this occurs when the order of the rock strata has been interrupted by the mere change in the direction of the outcrop. While in the original forest the areas of dissimilar growth are coextensive with certain classes of soils, and the same is more or less true of the aftergrowth in culled and coppiced woodland, in the great body of second growth seedling woods the effects of these differences in soil are largely obscured or altogether lost.

The most radical change which is taking place in the great body of the woodland is the change of growth from pine and mixed hardwoods to pure pine, by abandoned fields being seeded in pine, the place of these fields being supplied for agricultural purposes by farther encroachment on the hardwood areas. But where the

relative proportion of the pure pine growth is already large, it is more desirable to reclear these old fields, on account of the ease with which these pine lands are made tillable, from the great absence of lateral roots in the pine growth and the quickness with which the stumps and roots decay in the sap trees, if cut in the spring when the beetles attack them, and the presence of the sap invites fungus diseases.

The body of the upland forest is composed of oaks with more or less hickory, and in places with short-leaf pine scattered among them. Other trees of industrial importance enter but slightly into their composition. This is the composition of the original forests as they now stand. The second growth, on the other hand, which in local cases is an exceedingly important element in the woodland, has pine for the forest body generally, and hardwoods as subordinate.

SOILS OF THE PIEDMONT UPLANDS.

The soils of these counties, unlike those of the coastal plain region, are very largely primary; or at least are not secondary in the sense of the transported drifts of the sands and loams of the uplands and the alluvial deposits of the lowlands of the east, but are derived from the decay of rock or rock-forming material *in situ*. This material generally forms the subsoil, which is covered superficially, to a depth of three to eighteen inches, by a top-soil, differentiated by natural elutriation of the finer, more adhesive or clayey parts, so as to be coarser in texture and not so stiff or brightly colored as the subsoil. This top-soil, unless its depth is ten inches or over, has very little influence on the kind of tree growth.

GENERAL CONDITION OF THE FOREST.

The woodland presents a general view of wide stretches of forest of broad-leaf trees, usually with irregular and broken cover, in places much culled, and with no undergrowth where pastured, and young pines or cedar appearing at intervals through them. This broad-leaf woodland alternates with small groves of pine, usually rather open or thinly stocked, the pine being the short-

leaf and scrub pine; or sometimes red cedar replaces it, or there are mixtures of these trees. The groves of pine or cedar are a young growth which has spontaneously appeared in abandoned fields. In the neighborhood of the towns the groves of pine are of greater extent, and the younger groves which are appearing are more compact, the older trees furnishing abundant seed; the broad-leaf wood is more restricted in extent and often largely formed of coppice shoots, among which many seedling pines appear when old pines are within seeding distance.

The original forest lands may be separated into three parallel belts, neglecting for the present the numerous local variations: (1) a more eastern with soils from slates, sandstone and gneiss and forests with a large proportion of pine, the *eastern pine belt of the Piedmont plateau*; (2) a middle belt with deep loamy soils mostly from granitic rocks and supporting hardwood forests of the first quality, with only small percentage of pine or none, the *broad-leaf forest belt of the Piedmont plateau:* and (3) the extensive areas of gneissic soils to the westward with smaller-sized hardwoods and more pine, the *western pine belt of the Piedmont plateau.*

THE EASTERN PINE BELT OF THE PIEDMONT PLATEAU.

The forest belt lying to the eastward with the woods composed of broad-leaf trees and pine can be separated into three divisions which differ essentially in the proportion of pine in their composition and the ability of the soil to sustain a hardwood growth of broad-leaf trees. There is:

(1) A more easterly division in extent nearly coinciding with the geological terraine of gneisses and granites, the forests of which are formed of both the loblolly and short-leaf pines with medium-sized broad-leaf trees. This is described under the name of the *forests of the eastern granite areas.*

(2) A division abutting the above on the west, and nearly including the Jura triassic red sandstone formation of the geologists, the original forests of which contain a large proportion of short-leaf pine, with small-sized broad-leaf trees, and a large extent

of young pine, both the short-leaf and loblolly, in pure growth, *forests of the eastern red sandstone.*

(3) A southeastern division with soils from slates, for the most part rather shallow, supporting forests of short-leaf pine and small broad-leaf trees, with only a small area of young pine in pure growth. This will be called the *forests of the slates.* This does not include the entire eastern slate area, but chiefly that in the more southeastern counties* of that belt, the general limits of which will be given in describing this head.

Such differentiation, it must be understood, is merely for the simplification of description; further division might well be made, but these show fairly well, being natural divisions, the most evident differences existing in the forests and the intimate relation existing between them and the soils.

THE FORESTS OF THE EASTERN GRANITE AREAS.

The northeastern counties of the Piedmont plateau region, Franklin, Warren, Vance, and the northern and central parts of Wake, with rolling surface, have generally grayish and loose top-soils, frequently gravelly, especially along ridges, from the detritus from numerous quartz veins, and red or reddish subsoils, deep, fresh or moist along hillsides, but often coarse-grained and porous.

The body of the forests is formed of post oak, black oak, white oak and Spanish oak, with a considerable intermixture of white, small-nut and pignut hickories, and, in most places, short-leaf pine. The larger forest pines have, however, been largely removed. Along the hollows and cooler slopes, mixed with the white and black oaks, are the northern red oak and yellow poplar, yielding a low grade of lumber, red maple and some ash; along the drier crests there is more post oak and often an increasing proportion of black-jack oak.

The woods around many of the towns, periodically cut over or heavily culled for fuel, are rapidly deteriorating into mere post oak and black-jack oak coppice, with, if fires are excluded and there are seed-bearing pines near by, an ever-increasing proportion of the short-leaf pine.

* Largely the Monroe slates. See Bull. 3, N. C. Geological Survey, 1896, p. 36.

While the greater portion of the original growth of short-leaf pine has been removed, there are now large areas of wood, either in a pure stand of short-leaf pine, or that species mixed with the loblolly pine, especially on the lower or moister lands; and these areas contain a considerable amount of merchantable timber, though usually of a small size and yielding only sap lumber. The re-growth pine is usually at its best when growing on hillsides in culled woods with white and black oaks, where rapid development is secured, and tall and straight stocks formed. That which has colonized old fields and there formed a pure growth is straight-stemmed if the stand is sufficiently thick; but the fields, first taken in thick sod of tall grasses, are usually burnt many times while the trees are yet small, and the growth, being thus kept thin, continues as it matures open and scrubby, while the trees have short boles. Below the pine, post oak and small hickories (especially white hickory) appear, and where the soil is at all moist or stiff the dogwood spreads.

The loblolly pine when in this re-growth, here and as far westward as its distribution extends, does not do well after passing into the pole-stage, if it is growing on dry, sandy or gravelly uplands; either it spreads out, and becomes short-stocked and limby, if an abundance of light is afforded, or, if that be denied, soon dies out.

Although the woods of these eastern granite areas have long been culled, they are still yielding much merchantable building material, besides fencing-timber, railway ties (chiefly from the post oak and white oak) and large amounts of fuel, both of pine and hardwoods.

A considerable quantity of yellow poplar and some ash is exported from these areas for the manufacture of pulp, while one local paper mill employs ash for this use.

There are several small mills sawing the second growth short-leaf pine, and a few sawing the original growth.

TREATMENT REQUIRED BY THE FORESTS OF THE EASTERN GRANITE AREAS.

These forests are in most places capable of producing oak timber of considerable size, except along the summits of the hills,

where the dry and coarse gravelly soils are more suited for pine than the larger and more exacting broad-leaf trees. Cattle have for a number of years been excluded from the greatest portion of the woodland in a considerable part of this area, and the beneficial effects of this is evident in the thicker undergrowth. The black oaks, particularly the black-jack and the Spanish, are generally increasing more rapidly than the white oak, and do not seem to be dying out so rapidly as in counties farther west.

The very large areas of loblolly pine growth in old fields should be favored when it is on moist soils or loose loams: but on all stiffer or drier soils that of the short-leaf pine should be favored. Thinnings might advantageously be carried out for each of these species, as will be described further on.

Along all gravelly ridges mature seed-bearing pines should be preserved as seed-trees, and the proportion of pine in the small oak growth on the crests increased; on the more fertile soils of the slopes and along the borders of the hollows the pines reach their largest size, but the competition there with the broad-leaf trees is such that it is only occasionally that a pine can succeed in reaching maturity if it spring up among the broad-leaf trees.

FORESTS OF THE EASTERN RED SANDSTONE BELT.

Contiguous on the southwest to the granite areas in Granville and Wake counties just described, and extending southward through Durham, the eastern parts of Chatham, Montgomery and Anson counties, are the sandy loams yielded by the Jura-trias red and brown sandstones. This belt or terrain varies from 8 to 16 miles in width, and though its surface is generally undulating it is broken and rugged only in the few places where sandstone ridges occur, as in portions of Chatham, Moore, and the southern part Anson counties.

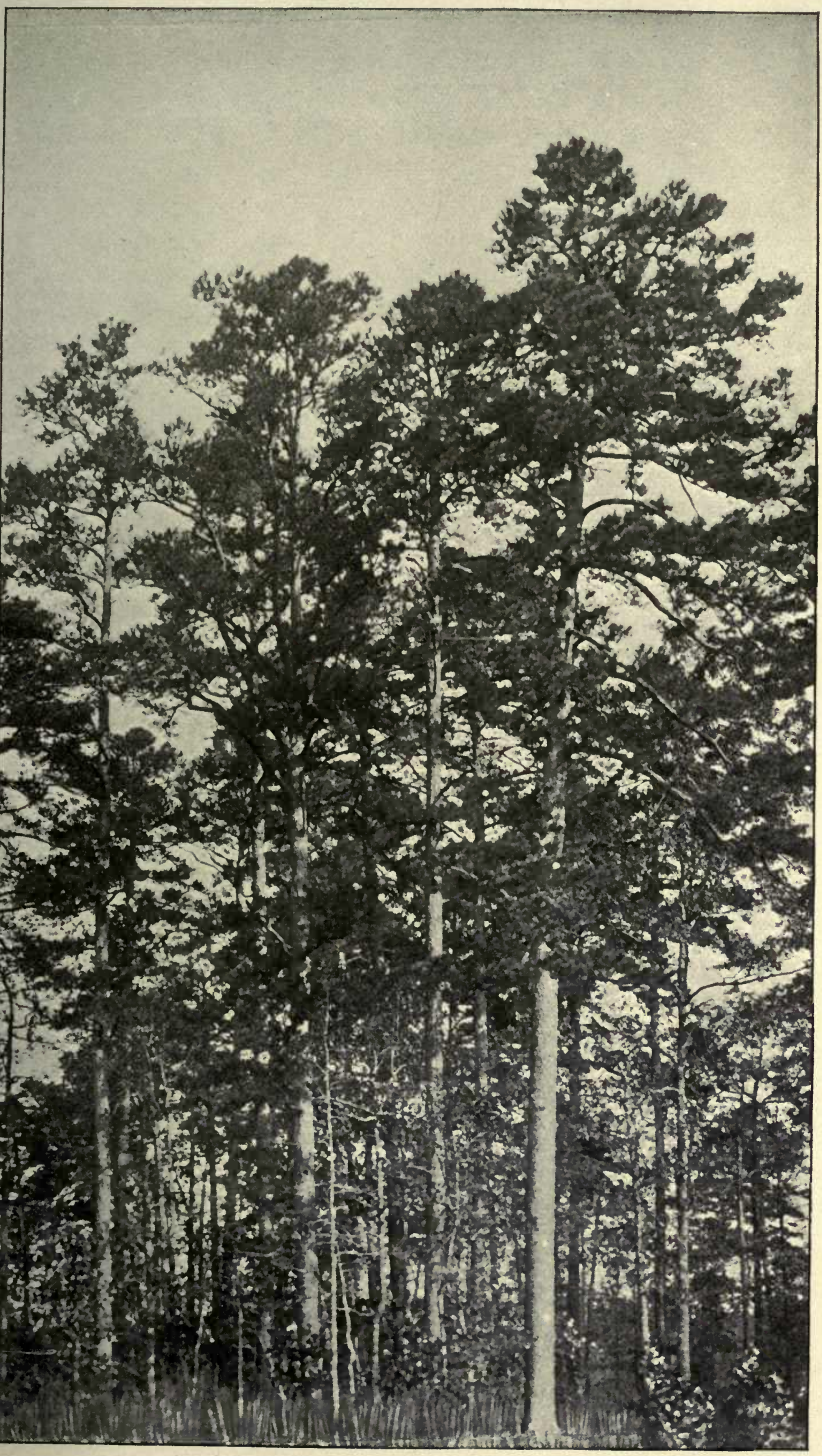
The soils vary from loose coarse-grained sandy loams to stiff fine-textured loams, the latter being generally confined to river bottoms. They are usually brown or gray in color, with characteristic brown, purplish, or terra-cotta-colored, stiffer subsoils; usually deep, but in spite of their depth ill-suited for tree growth.

Under denudation they wash badly, and all the finer and more silty soils bake in drying.

On the flatter lands the forests are formed of small-sized trees. In the original growth there is usually an upper dominant story of short-leaf pine from 50 to 70 feet in height, with an underwood of post oak, Spanish oak, black-jack oak, white oak, and white hickory. This often merges into post oak and black jack oak flats; or where the soil is stiffer and the country more rugged better oaks are to be found along the slopes and in the hollows. The original growth has been largely removed. (Plate XXII.)

In the southern portion of Granville, the southwestern part of Wake, and Durham, and the eastern part of Chatham counties are large areas of abandoned agricultural lands under cover of the short leaf and loblolly pines. The pine may be seen in all stages of development, though in one grove all trees are about the same size. The loblolly is for the most part confined to the lower or flatter lands, the short leaf to the better-drained soils and those situated at a distance from large streams where there are the seed-bearing trees of the loblolly pine. In many places the two pines occur mixed; but the loblolly generally displaces the short-leaf, growing more rapidly and enduring greater lateral compression and shade than the latter. On the driest soils, however, the short leaf finally outgrows the loblolly and prevails. Much of this pine is of good stand and has tall and straight bodies free from limbs, and this is more true of the loblolly pine groves than of those of the short-leaf; but much more of it has been thinned by repeated fires, and is capable of yielding but little wood except for fuel. The floor is generally covered with a thick sod of broom-grass. Only a few broad-leaf trees appear spontaneously beneath these pines; those which do occur are chiefly post oak, white hickory and dogwood.

In Anson county there remains but little of the original forest. North of Wadesboro the soil is a gray, sandy loam, rolling and moist, covered with a generally compact growth of the loblolly pine, which is of fairly uniform size; high poles or small-sized mill-timber, where large tracts of cotton lands were simultaneously abandoned in the period between 1861 and 1868, and have not



MIXED PINE AND HARDWOOD FOREST OF THE PIEDMONT PLATEAU REGION

since been re-cleared. Beneath this loblolly pine there is very little hardwood growth. South of Wadesboro the topography is more rugged, and the soils are stiffer, and along the crests and upper slopes often shallow. Everywhere it has been badly eroded. The short-leaf pine holds possession of the large extent of old fields, with, in some places, a small proportion of loblolly pine intermixed. The growth is open and stunted and in many localities dying out. There is little underwood and a consequently poor floor. To the eastward along the Pee Dee river, lie the light loams of the long-leaf pine belt, on which at the present time in Anson county, there are not over 3,000 acres of good standing pine. The remainder of the long-leaf pine lands in this county, as has been said, are covered, where the soils are dry, with small broad-leaf trees, chiefly post oak and black-jack oak; or where the soils are moist with an open, spreading growth of the loblolly pine.

The greater part of the woodland of these counties, possibly as much as two-thirds of it, is in young groves of pure pine. The so-called "forest" pine has been nearly removed; some is yet held in a few places. There are considerable areas of small-sized short-leaf and loblolly pine timber suitable for milling purposes, making sap lumber. Only a little of it has been cut, that chiefly for making tobacco tierces. From the broad-leaf trees (the white and post oaks mainly) hoops and staves and railway ties are made. Some dogwood is gotten out for shuttle-blocks. There are few wood-working industries, and these are chiefly saw mills, supplying in part the local demand.

IMPROVEMENT OF THE FORESTS OF THE SANDSTONE BELT.

The moister soils are capable of producing loblolly pine suitable for saw-logs, and medium-sized white and Spanish oaks. The drier soils can grow rather small-sized trees of the short-leaf pine, post oak and small-sized white oak.

Protection from fires is needed; browsing cattle do only slight damage, except where there is a very large proportion of broad-leaf trees. All young short-leaf pine appearing in lumbered woods should be protected.

The thick groves, particularly those of the loblolly pine, might well be thinned. Very lightly at first, if the stand is very thick, and the thinning repeated after several years. If the stand is not so thick a correspondingly light cutting will be required. Seeding pines should be left around every cultivated field which in time may be abandoned, so that when cultivation ceases it may quickly be seeded in self-sown pine seed, and the young pines serve as a protection to prevent the washing away of the soil as so much of it is now destroyed.

The loblolly pine can be grown in a pure forest on all the moister soils of this division. The short-leaf pine does well in a pure growth on the better soils. On the poorer soils all the groves of untended trees now have too open a stand. This may be due entirely to external influences; in many places it is evidently traceable to fires. If this be due in certain cases to the natural thinning out of the pine on such soils as the trees become of large size, in all such cases underplanting will have to be resorted to.

FORESTS OF THE SLATE SOILS.

The geological formation of crystalline schists and slates, which extends from Person county southwestward to Union, yields two extreme types of soils, each supporting characteristic growth. The first of these to be here described is the less suited for the growth of trees, and has woods of pine and small broad-leaf trees; the second produces woods of broad-leaf trees of a larger class and no pine, and will be described further on in considering the belt of red and gray loams which lies next to the west.

The first soil referred to as being a characteristic one over a large part of these counties is a usually shallow, close and stiff, yellow loam, sometimes superficially sandy, derived from gray or yellow slates, and is nearly confined to the southern counties: Randolph, Stanly, Montgomery, and Union. The topography of the districts where such soil is found is simple, the surface nearly flat or gently rolling. Throughout it is ill-drained, and the variation in the growth is incidental to the thoroughness of the drainage. Where better drained the forest resembles a two-storied high forest. The upper story consists of a rather open growth of short-

leaf pine rising to a height of 50 to 70 feet; the lower story of small post and black-jack oaks, with more or less Spanish and white oak and white hickory, has an average height of 40 feet, individual trees acquiring a diameter of 14 to 18 inches. The trees are often shrubby, and there is very little young growth. As the soil becomes poorly drained the pine decreases, until on the "willow oak flats" the growth becomes restricted to black-jack and post oaks as a lower story, slightly overtopped by willow oaks, a growth capable of yielding only a limited number of ties, and felloe and hub-material.

In Davidson, Stanly and Union counties mines have been worked for many years, requiring large amounts of fuel and posts which have been gotten from the neighborhood. Such deforested districts are now generally covered with a coppice of good stand, often with many young pines and some seedling oaks intermixed. Along many of the river hills through here thickets of the scrub pine may be seen. It appears to be spreading eastward from the granite knobs above along the rivers, occasional trees yet being seen in culled or coppiced woodland as far to the eastward as Orange county.

There is a comparatively large part of the area of these counties in forest and only a small amount of second growth woods; and as the woods have been but little culled a correspondingly large amount of merchantable timber, pine in places and oak suitable for ties and wagon-material. These forests have in many places been badly injured by frequent and destructive fires, but during late years the woods have been better protected and the adoption of laws requiring the confinement of live stock in several of the counties has tended to diminish the evil and at the same time improve the general condition of the woodland.

The soils of the first division are on the whole too shallow to make large-sized broad-leaf trees. The most valuable tree is the short-leaf pine; next the post and white oaks and white hickory and dogwood. The pine will make medium-sized mill-logs; the oak scarcely more than railway ties and smaller material.

Fires should be rigidly excluded, as their damage to young pine is great. In most places cattle should be excluded. Improve-

ment cuttings could be advantageously conducted throughout nearly this entire section, defective pines being removed and old black oaks and Spanish oaks that are interfering in any way with young growth of more valuable species. The proportion of pine can be largely increased in such soils as are sufficiently deep to permit its growth, the amount of post oak increased on the crests of ridges, and of white oak on the slopes and better soils.

THE DECIDUOUS FORESTS OF THE PIEDMONT PLATEAU.

Beginning in Mecklenburg county and extending northeast through Cabarrus, Rowan, Davidson, Guilford, and Caswell counties and west to the middle parts of Davie, Yadkin, and Rockingham counties are red and gray compact loams, sometimes loose, rarely sandy, derived largely from gneissic or granitic rocks; and with these may be included the loose loams of Orange, Granville, and Alamance counties, and the stiff red loams of central Iredell, middle part of Lincoln and Catawba counties, and the loose and sandy red and gray loams of southern Cleveland and Rutherford counties. This territory embraces the great body of the fertile upland soils, both stiff and loose, of the Piedmont plateau.

The forests were originally of the first quality, consisting of compact-growing hardwoods, oaks, and hickories, with pine disseminated only on rocky or sandy soils along the crests of hills. They differ from those lying to the eastward in the almost total absence of the short-leaf pine in the original forest, the rather limited area of young pine in pure growth, and the presence in many sections of the red cedar and scrub pine as the old field growth.

FORESTS OF THE COMPACT RED LOAMS OR "RED CLAYS."

The stiff red soils, the so-called "red clays," derived from hornblende-bearing rocks are fertile, and are usually free from stones. The soils are in narrow terraines, two to twelve miles wide, lying in a northeast and southwest direction, the largest extending from Charlotte to Concord, with a length of about

thirty-five miles. Other extensive bodies are at Salisbury and Lexington ; several smaller are in Guilford county, and a large body extends through central Alamance and Orange counties, and the northwest part of Person county. Besides these bodies are the areas in Catawba, Lincoln, and Iredell counties already referred to, and smaller areas in other portions of these counties.

The forests of the compact red loams are composed of black and white oaks, white and small-nut hickories with small intermixture of Spanish oak, and along the crests of the ridges, of post oak ; but on lower hillsides and steep north slopes the yellow poplar, northern red oak, shagbark hickory, and white ash also occur. These trees in the most favored situation form a forest whose canopy is raised 90 to 100 feet, and the trunks which support it are free from limbs for 40 to 60 feet. Beneath these trees where there has been no pasturage there is in many places a heavy undergrowth of dogwood and young trees. The wooded land is for the most part distributed among small farms, and much of it has been heavily culled of the white oak for building and fencing-material, and in places the Spanish oak has been removed for the same uses. Where such culling has been done and the woodland pastured at the same time, the growth has remained open and there is no underwood : and although in many such tracts no pasturage has been permitted for the past five or ten years, the reproductive power of the black oaks seems to be so impaired, possibly from the dry and impoverished floor, that seedlings are infrequent and small, and few young black oaks are to be found in the undergrowth now appearing, which consists of dogwood, hickories, haws, and young white oaks. There are still many fine bodies of hickory, although much has been cut from these lands for numerous local buggy and spoke factories, and much has been exported in the log.

Old fields on the compact red loams are not frequent, and they are either tardily taken by pine, the seed being borne there from trees at a distance on other soils, or sometimes they are taken by thickets of sassafras, sumach or by persimmon, and in a few localities by red cedar. Sometimes, however, a growth of mixed

broad-leaf trees, whose seedlings are light-bearing, appear, Spanish, post, and white oaks, white hickory, dogwood, and sourwood.

IMPROVEMENT OF THE FORESTS.

These forests are capable of yielding large-sized oak and hickory timber. The white and black oaks are the most valuable trees growing on these soils, and are better adapted to them than the others; the Spanish oak is less suited. Of the hickories the smallnut and the white make the most rapid growth and thrive better on this stiffer soil; the small-nut on the shadier slopes or where the stiffest soils prevail; the white where the soils are drier or not so stiff. The short-leaf pine will attain a large size and make exceedingly rapid growth, either in growth with other trees or when growing alone.

Browsing cattle and hogs should be excluded, and fires, which at present are of seldom occurrence, should be guarded against. Where the woods have not been pastured there is usually a heavy stand of young trees beneath the old ones, and generally of the same kind, although not by any means in the same proportion. There are great numbers of white oaks, especially four-year-old seedlings, and thickets of saplings, from the two latest heavy masts, around and beneath seed-bearing trees; and this young growth is most promising. Defective old trees, or objectionable species, black gums, scarlet oak and other trees of less value which by their shade are interfering with such young growth should be removed, and if it will pay to turn them into cord-wood they should be cut up and hauled out, as little cutting and injury being inflicted on the young growth as is possible.

There is in some places much mature timber: when it is post oak, chiefly suitable for railway ties; when white and black oaks, it will yield small-sized milling timber, and this is often standing to the great detriment of the thick young growth beneath it, and might well be partly removed to give the young growth an opportunity for development.

Where pasturage has been uninterruptedly practiced for many years and the woods are open beneath, there being no underwood of young trees, an absolute exclusion of cattle is demanded in

order to secure the regeneration of a new crop beneath the old trees. Where lack of grazing lands makes woodland pasturage necessary, the plan of utilizing one-half of the woodland for grazing until the young growth in the other portion becomes too large to be injured by cattle, and then turning the cattle into that, while the pastured area is permitted to rest and secure a new growth, could be adopted. Where there are yet many black oaks, white oaks and hickories standing, they can be allowed to naturally seed the ground, and the seedlings from them form the new wood.

In places, however, these species are nearly wanting, or the white oak has been largely removed, so that if a new crop were to be naturally regenerated beneath the remaining trees it would be formed largely of little-desired species. Underplanting with the white oak, and retaining the old cover for several years, and then removing it after the young white oaks have formed thickets so as to shade the ground, is here recommended. The most naked spaces, without any cover at all, might well be sown in the short-leaf pine.

Some localities show absolutely no signs of young growth of broad-leaf trees except such kinds as are neglected by browsing cattle; the old trees which are standing have passed their maturity, their tops are decaying, the trunks are often hollow, and their vigor is constantly lessening from the free access of the sun to the soil around their roots. Any kind of a young growth in such situations will be valuable in protecting the soil from washing and preventing the further decay of the old trees by shading their roots. Nearly all of this thinned wood has more or less young short-leaf pine in it which is rapidly increasing, being passed over by cattle.

THE FORESTS OF THE LOOSE GRAY LOAMS.

The forests of this division cover the greater portion of the section of the Piedmont plateau which lies between Rutherford and the southeastern part of Mecklenburg, on the south and west, and Yadkin, Rowan, Caswell and Orange counties on the north and east; within this division lie the smaller areas of compact red loams with their somewhat different growth. There is not always

a sharply defined limit between the loose gray loams and the compact red loams, one gradually passing into the other; more often the areas of compact red loams have sharply defined limits. The more sandy soils prevail, however, in Alamance, Orange, the western portion of Chatham and in Person counties, in the southern portion of Mecklenburg, and the southern parts of Cleveland and Rutherford counties.

The gray loams are loose, even sandy in places, with the subsoils stiffer and bright-colored, deep, well drained, but fresh or moist and well suited for tree growth. In a few places they are rocky or even bouldery as in portions of Orange and Alamance counties.

In general, the forests are quite similar to those of the compact red loams; but the Spanish oak to a large extent replaces the black oak; there is more post oak, and the standard of excellence is not so high.

The composition of the original forest may be said to be of white oak, Spanish oak, post oak, black oak, white hickory, and scarlet oak, in relative abundance about in the order named, and forming over three-fourths of the growth; beneath these trees is a selection of underwood, where it has not been suppressed by pasturage, which shows a fair representation of the dominant trees, and with these the dogwood, sourwood, haws, and thorns. Dogwood, however, is not so abundant as on the compact red loams. On slopes facing the north and cool hillsides there is but little ash and red maple, and only occasional trees of the northern red oak, but yellow poplar is more frequent.

Pine, though infrequent on the stiffer soils and confined to the ridges, forms on the looser a not inconsiderable element in the woodland, from ½ to 2 per cent. of the mature trees often being pine, these being large and tall, but scarcely overtopping the hardwoods.

Where the soil is poor and sandy as in southern Mecklenburg, there is a reoccurrence of the pine, post oak, and black-jack oak growth, with the pine as an upper story and the broad-leaf trees as a lower. The area of such sandy land, however, is limited, and it is generally largely cleared for cotton culture, with the greater part of the woodland hardwood coppice and pine regrowth.

To the eastward in Person, Orange and Alamance counties the small shagbark hickory is frequent along the crests of sandy ridges, forming in a few places as much as 10 per cent. of the growth over limited areas.

Where high hills occur with sandy or gravelly crests, and especially if bouldery, as the river-hills along the Deep and Haw, and the elevated ridges in Person county which centre around Fuller mountain, the chestnut oak becomes conspicuous, and in culled and coppiced woodland rapidly propagates, seeding at an early age, and abundantly reproducing from stool shoots.

Coppiced and culled woods deteriorate in two directions according to the kind of soil on which they grow; if on sandy soils the early seeding black-jack oak and post oak increase, their seedlings, appearing among the stool shoots, the trees of these species becoming large enough to produce seed before those other kinds; on the stiffer red soils where the black-jack oak is wanting, the sourwood increases rapidly for the same reason, it seeding at a very early age, especially from shoots.

On the hillsides in culled woods many maple seedlings occur, and reach a height of 20 or 30 feet, and then die. The black gum does the same, small trees of this species often forming a considerable proportion of the young growth; but although it reaches a much larger size than the red maple, and persists for a far longer time, it, too, is finally suppressed by more rapid-growing trees which are better suited for the dry soils. To a less extent the same is true of the sweet gum, but unless in rather favored localities its seedlings, which appear in many places in the woods, die after a few years growth.

Where the soils are not too sandy or thin there is a growth of broad-leaf trees nearly as excellent in quality as that on the compact red loams. Its average height, however, will scarcely exceed 85 feet, and as the soil becomes more silicious there are fewer small-nut and shagbark hickories and black oaks, these being supplanted by post and Spanish oaks; or, if the country is rugged and the crests of the hills rocky and gravelly, especially if with quartz fragments, the scarlet oaks and pignut hickories enter largely.

These forests require the same management and care for their improvement, as was indicated for those of the compact red loams.

GENERAL CONDITION OF THE DECIDUOUS FORESTS OF THE PIEDMONT PLATEAU REGION.

Between 80,000 and 100,000 acres of oak and hickory woodland situated in Person, Caswell, and Granville counties were burned in the spring of 1893. The greater portion of the mature and large-sized oak and hickory timber was killed; and while the tops of all smaller trees were destroyed, they put forth abundant stool shoots so that the burnt areas are now covered with thickets of young sprouts. There is another large burnt area in the north-eastern portion of Rockingham county over which a fire passed about 1875. This is now covered with a thick growth of small trees about twenty years old, there often being several stocks from the same stool so that they interfere with each other and prevent development.

While at the present time, on account of the general distribution of groves of seed-bearing short leaf pine, this species quickly forms a stand in abandoned fields, as is the case from Rutherford, Cleveland, and Mecklenburg counties north to Davie and Guilford, yet in many portions of southern Alamance, the northern parts of Orange, in Person, Caswell, and the eastern parts of Rockingham and Forsyth counties, the short-leaf pine does not rapidly take old fields, from five to ten years or even more being required for a thick stand to be naturally secured.

In the eastern portion of Guilford county, and in Alamance, Orange, Person, and Forsyth there is a large proportion of red cedar associated with the short-leaf pine, in localities where the pine does occur in the old field growth; but the cedar is finally suppressed by overshading. In some localities cedar unmixed with other trees forms the regrowth. This tree is also rapidly increasing in culled woods, but, as in the pine groves, it is unable to endure the deep shade of the broad-leaf trees, being of much slower growth than they, and is at last overshaded. In the counties to the west of Guilford, and especially in those to the south-west, there is not so much red cedar.

Where neither the red cedar nor short-leaf pine appears in the old fields, as in portions of Guilford, in Caswell, especially in the valley of Country Line creek, in Rockingham and Forsyth counties, and to a less extent elsewhere, the scrub pine forms a large portion of the regrowth in old fields, in many places forming compact thickets of pure growth; in others, thickets of the short-leaf pine and scrub pine alternate. The two pines are sometimes associated. When this is the case unless the short-leaf pine has the advantage of a start of a few years growth, the scrub pine, being the more rapid grower, will overshade it and suppress it. Less frequently is the scrub pine associated with red cedar in these groves.

The scrub pine forms groves of pure growth on the granite knolls which extend across the eastern edge of Cabarrus county into Rowan, and the dissemination in the old fields has probably been from the trees on these knolls and those growing along the hills of the Haw and the Deep rivers, as the scrub pine is not found at other places in this division in the original forest.

Probably as much as one-third of the area of this division is in wood, and over one-half of the wood is regrowth. A greater portion of the regrowth, over a third at any rate, is pine and cedar. There are besides large areas of waste lands, with almost no tree growth of any kind, or exceedingly thinly stocked with pine or oak, chiefly post oak, black-jack oak, and Spanish oak stool-shoots.

There is almost no merchantable heart-pine suitable for milling. The local bodies of regrowth pine which are now large enough for small sized saw-logs will yield only sap lumber, and are not generally utilized on this account; but there are large quantities of pine suitable for fuel. There is not very much oak, either white or red oak, which is suitable for lumber. What there is lies chiefly in Orange, Person, and Davidson counties; but there are smaller bodies in other places. Smaller white oak and post oak, suitable for railway ties, in most places is not abundant, many sections not producing enough to supply the local demand. Hickory, however, is relatively more abundant, not having been so largely culled for local use; numerous spoke and tool-handle fac-

tories are now utilizing this. There are few saw-mills, and nearly all of the building material used by the larger towns is brought from other sections of the State.

THE WESTERN PINE BELT OF THE PIEDMONT PLATEAU.

Lying to the west of the compact red and gray loams are fine-grained and mostly sandy loams, usually red or reddish in color with a thin surface soil, usually less fertile than the compact red and gray loams and less suitable for tree-growth. This division extends from the central part of Rockingham, Iredell, and the central part of Rutherford counties northward and westward to the base of the Blue Ridge and its outlying spurs. A few local areas of compact red loams occur, and the original timber on these soils was entirely of broad-leaf trees.

The surface of the entire division sloping eastward from the escarpment of the Blue Ridge is broken and rugged. The culminating points of the divides between the rivers which here find their head waters are low mountain chains running irregularly east and west. These mountains and the groups and isolated peaks, lying still further to the east, the Sauratown and Crowder mountains, and Kings mountain have an arborescent growth similar to that on the eastern slope of the Blue Ridge, and their woods will be considered in connection with that (p. 210).

Here, however, it may be well to say that the woods on the north slopes yet contain some merchantable yellow poplar in some of the hollows, with ash, northern red oak, and white oak. The woods on the southern slopes, and this is especially true of the South mountains, the Sauratown and King's mountain, and the broad water-shed between the Green and Pacolet rivers, have been many times burned, and pine timber has been very badly damaged while tie and tan-bark oak has been greatly thinned or reduced to stool-shoots.

The forests of this division are of pine mixed with broad leaf trees, of which the scarlet oak is the most abundant. It is especially common on gravelly soils and has associated with it the Spanish oak, post oak, white oak and, to a less extent, the black oak, while along all high and sandy crests and rocky slopes the

chestnut oak becomes a tree of economic consideration. There is not so much hickory as in the oak forests of the central portion of the state this group being represented chiefly by the pignut, white, and some smallnut. The sourwood becomes even more conspicuous than in Davie and Guilford counties, and along the hollows and northern slopes there is some yellow poplar, ash and northern red oak.

These woods are in a far more uniform condition than those lying to the eastward and are much less broken. There are broad expanses of woods, formed of pine mixed with broad-leaf trees, with the cover entire or somewhat broken, and dotted with small groves of pure pine, either the short-leaf or the scrub, in old fields; or there are extensive areas of culled or coppiced woodland adjacent to the farms and small towns.

Throughout some portions of the division cattle have been excluded from the woodland for periods of from five to ten years, but most parts are yet pastured. The forest floor is generally poor, the underwood thin or entirely absent, and the cover of the mature trees open.

The original forest is from 70 to 80 feet in height, though in many places it will not be over 60 feet where the soils are thin and poor, while in hollows and on cool slopes many trees will measure over 100 feet in height. Considering the division as a whole, the trees stand in relative abundance about in the following order: short-leaf pine, scarlet oak, black oak, white oak, sourwood, chestnut oak, post oak, Spanish oak, and white hickory. These form considerably over three-fourths of the growth. Less abundant and forming the larger portion of the remainder of the growth are the dogwood, pignut, chestnut, black-jack oak, black gum, and small-nut hickory, scrub pine, and red maple.

The culled woods show an increased proportion of young pine; while scarlet oak, chestnut oak, and sourwood are increasing in both culled and coppice woods, the scarlet oak more rapidly than any other oak. Its young growth often forms thickets in the open spaces where trees are removed in culling; and in coppiced woodland it reproduces rapidly both by seedlings and stool-shoots. It is chiefly on the drier sandy and rocky soils that the chestnut

oak is spreading most rapidly under culling, especially where the cutting is heavy or where the woods are coppiced; so that large areas where fuel is regularly cut show a growth which has deteriorated, so that while it formerly consisted of mixed oaks and hickory, now it is of scarcely other trees than the scarlet and chestnut oaks. Both of these trees, however, are well-suited for coppice-cutting on account of their rapid growth, vigorous sprouting, and the long persistence of the stools.

The increase of the red maple in culled woods is also rapid. Under the protection of the light shade so afforded maple seedlings can be found on all classes of soils from the driest to the most moist. On the moister soils they seem to be incorporated as a permanent part of the growth; but where the soils are dry they grow more slowly and are overtopped by the oaks when eight or ten inches in diameter, put up sprouts from around the base of the trunk, the main stem becomes weakened and dies. In like manner many seedlings of the yellow poplar appear; those on the drier soils soon succumb; those on the moister persist for a long time, if on a north slope even becoming large trees. Black gum seedlings, which are frequent on the drier soils, continue to grow for many years, but the specimens never become more than small-sized trees.

The regrowth in the old fields is uniformly pine, except in a few local areas of compact red loams, where it may be red cedar or scrubby broad-leaf trees as well as pine. The pine in old fields is usually the short-leaf; but in some sections it is the scrub, especially where adjacent to the mountains, or where thickets of that pine occurred in the original growth, as along steep river hills or the thin soils near granite knolls, the so-called "flat-rocks." Less frequently white pine forms the old field growth, and then only at the base of the mountains where mature trees of this species occur. Beneath pine regrowth of all kinds, unless the cover is exceedingly heavy, sourwood, red maple and dogwood appear.

MERCHANTABLE TIMBER OF WESTERN PIEDMONT PINE BELT.

The forests of the western pine belt now yield more timber than those of any other part of the Piedmont plateau region, and

exploitation is not so far advanced in them as elsewhere. There are many mills sawing pine and soft woods in Wilkes and the northern part of Alexander counties; mills cutting hardwoods at Hickory, Morganton, Lenoir, Old Fort, Thermal Springs and at other localities, while mills sawing pine are scattered through the entire territory.

Several local tanneries obtain their bark supply, chiefly chestnut oak and white oak bark, from the immediate neighborhood, but they have removed only about one-half of the available amount in the South mountains, and that in the Brushy mountains and on the slopes of the Blue Ridge has yet scarcely been touched. The largest tanneries are at Morganton and Wilkesboro.

The largest areas containing merchantable pine lie in Caldwell, Burke, Alexander, Wilkes, and the northern parts of Cleveland and Rutherford counties. Some white pine of a low grade is furnished by the counties lying along the base of the Blue Ridge. It is locally used for building material, but far the greater part of the lumber manufactured is utilized in making shipping boxes for local cotton and woolen mills. The northern pitch pine occurs through here above an elevation of 1,300 feet, usually growing with the short-leaf pine and distinguished from it under the name of "black pine"; and along the mountains, above an elevation of 2,000 feet occur occasional specimens of the Table-mountain pine, which finds its eastern limits on the rocky summits of King's mountain in the southeast and the Sauratown mountains in the northeast, though in the intervening territory between these two mountains and the ridge of the Brushy and the South mountains it is not known to occur. All of these pines afford merchantable milling timber. The scrub pine is abundant on the shallow soils of the mountains and along the Blue Ridge, frequently forming small patches of unmixed growth. The milling oak timber is the white, some Spanish, red and black oak; there is a great deal of white and chestnut oak tie-timber, but not so much post oak as farther eastward, the scarlet oak largely taking its place.

IMPROVEMENT OF THE FOREST.

These forests are capable of yielding short-leaf pine, which will

on the best soils attain a height of 90 feet, and on the poorer a height not exceeding 70 feet; and many of the soils, on account of their poorness, are much more suited for a growth of pine than of more exacting broad-leaf trees. The white and chestnut oaks grown on the crests of the hills will make trees large enough for railway ties and tan-bark but scarcely larger; on the moister upper slopes the black and white oaks attain sizes which make them suitable for milling-timber; on the cooler and moister lower slopes the white oak, northern red oak and yellow poplar attain moderately large dimensions and form good timber. The Spanish oak generally reaches only a small size and is often defective; and the same is true of the scarlet oak. Sourwood large enough to be of value commercially is usually defective. The white pine will certainly do fairly well in a few localities along the western limits of the division, and though at this low elevation it fails to clear the stocks, at least in the forest specimens, as it does at a higher elevation, it is worthy of being protected on account of its rapid growth. Thickets of pure growth will probably form cleaner shafts than where single specimens appear in mixed woods.

The broad-leaf trees require such care as was indicated for those of the compact red loams (p. 198). The white pine can be treated in the same way as will be given for the groves of that tree occurring in the high mountains (p. 218).

FORESTS OF THE MOUNTAIN REGION.

The differences in the character of the forests of the mountain region are not determined so largely either by the kind of soil or by the amount of moisture contained in it as are those of the Piedmont plateau and coastal region. Within short distances among the mountains there are wide variations in elevation. With increased elevation a rapid lowering of the average annual temperature takes place, and a proportional shortening in the growing-season; increase in the rain-fall and relative humidity, and a decrease in evaporation both directly from the soil and through transpiration. The effect of these factors in limiting the distribution of certain species is more evident than that of the soils; though, between certain limits of elevation, changes in the

character of the soil influence the kind of growth. It is doubtful, however, if changes of soil in the larger mountain masses above 5,000 feet elevation produce any change at all in the kind of trees, the number of species being limited to those whose hardiness of crown or foliage and short growing-season render capable of withstanding the sudden changes of temperature to which they are subjected toward the summits of the higher mountains. At high elevations certain trees are to be found both along dry ridges and in cold swamps; the white and pitch pines and black gum; and, choosing less noticeable extremes of soil, are the red oak, hemlock, beech, birches, and sugar maple.

The forests of the mountain region are separable into three zones or belts lying at different elevations. These may be described as follows: (1) The forests of the lower mountains; (2) the forests of the higher mountains; (3) the forests of the mountain summits.

THE FORESTS OF THE LOWER MOUNTAINS.

The forests of the lower mountains lie between 1,500 and 3,000 feet elevation. They occupy the eastern and southern slopes of the Blue Ridge and its outlying spurs, and the minor chains of the Brushy and Sauratown mountains which penetrate or lie within the Piedmont plateau region; and to the westward of the Blue Ridge they occupy the hills and lower mountain slopes about to the maximum elevation given above.

Oaks, white, chestnut, black, scarlet, red and shingle, with some hickory, chiefly white, bitternut and rarely the shagbark and smallnut, with the chestnut and occasionally dogwood, are the chief broad-leaf trees. The pines are the short-leaf, pitch, Table mountain, scrub (Jersey) and the white. These form a story of varying density, but never constituting over one-half of the trees, slightly above the broad-leaf trees; or are coordinate with them and fewer in number. As the quality of the soil improves, either as regards fertility or constant proportion of moisture, and the individual specimens composing the broad-leaf element reach a larger size, the pines become fewer in number, restricted in kind to those attaining the greater size, the white and short-leaf, and are con-

fined to the more rocky and shallow or sandy-soiled crests, and eventually are crowded out; either because the broad-leaf trees overshade the mature light-loving pines, or because their shade becomes too deep for the growth of the young plant.

DISTINCTIVE GROWTH.

The forests of the lower mountains approach in the character of their economic trees those of the western gneisses of the Piedmont plateau. The pines, except the short-leaf and the scrub (Jersey) are usually kinds which are not frequent in any part of the Piedmont plateau region; the chestnut oak becomes frequent; the post oak and Spanish oak do not occur at all over the larger part of the area; and the red oak, shingle oak, and chestnut oak become conspicuous and valuable trees.

The forests of the lower mountains are separable into three divisions: (1) that in which the Table mountain and pitch pines are the dominant resinous trees; (2) that in which the short-leaf, pitch, and scrub pines are dominant; (3) that in which the white pine is the dominant tree.

TABLE MOUNTAIN PINE DIVISION.

The area in which the Table mountain and pitch pines are the important pine timber trees embraces the eastern and southern slopes of the Blue Ridge, with the outlying spurs, from Georgia to Virginia, and the groups of the Brushy, South and Sauratown mountains. With these pines is to be found the short-leaf pine, which becomes more abundant as the elevation decreases and the soil become deeper and less rugged. The slopes of this range are steep; the soils are shallow loams or sandy loams, eroding rapidly under denudation, and, when cleared, restocking slowly on the cessation of cultivation. The broad-leaf trees which are associated with the pines are chiefly the scarlet and chestnut oaks and the chestnut. These form a low, open growth, seldom exceeding fifty or sixty feet in height. There is no underwood, and it is only occasionally that young trees are found, and these are for the most part stump or stool-shoots from trees the tops of which have been

killed by the frequent fires which ravage these forests. Old trees, particularly oaks and chestnuts, show many defects from these fires, chiefly short and limby boles and hollows. Pasturing cattle and ranging swine are regularly practiced; firing is done to improve the grass crop and secure young stool-shoots in the spring; and to clear off the litter before the fall of chestnuts and acorns in the autumn. Locally, white pine occurs. Their boles, however, are short, limby and frequently defective, the heartwood being subject to the attack of Trametes pini, which caused defective stocks. The Carolina hemlock, the bark of which possesses the same tanning properties as that of the hemlock, is confined for the most part to the eastern slope of the Blue Ridge. Locally abundant, it is found at intervals along this mountain chain, to the west of it on rugged cliffs along the north and south forks of the Estatoe river in Mitchell county; the South Fork of New river in Ashe county; the gorge of the Doe river; and in the southeastern parts of Macon and Jackson counties, and in one locality over forty miles to the east of this range, the Sauratown mountains.

In the deep, narrow hollows which indent the eastern slopes of the Blue Ridge, the black walnut grew more abundantly and reached a larger size than elsewhere in this State; but it has been largely removed, and there are now only a few small trees. Of the locust, yellow poplar, and white oak which grew with it, only the white oak is still standing in large quantities. The timber in the hollows, where there are few pines and but occasional hemlocks, has been less damaged by fires than that of the drier and more exposed slopes. Browsing cattle, however, have checked the growth of most of the young broad-leaf trees.

MERCHANTABLE TIMBER OF THE TABLE MOUNTAIN PINE BELT.

There is now comparatively little merchantable timber lying along the Blue Ridge. Locally there is white pine, and yellow pine of several species suitable for milling purposes; and in the hollows some yellow poplar, white oak and chestnut suitable for lumber. White oak and chestnut oak railway tie-timber is abundant, and large quantities of white and chestnut oak tan bark are

obtainable. Lumber mills obtaining their logs from these forests are in operation at Lenoir and Hickory, and smaller mills elsewhere. A tannery at Morganton depends on these forests largely for its oak bark. Fires have damaged these forests more than those of any other part of the State except the pine woods of the southeastern counties.

The forests cover nearly the entire area. The farms are few and confined almost entirely to the narrow alluvial bottoms; a few clearings have been made on the more gentle slopes or broader rounded crests. Some bottoms have been permanently damaged by washing during floods and the deposition of a heavy mud sediment on the surface of the loams. Old fields are seeded chiefly by the short-leaf, scrub and northern pitch pines; less frequently by the white. Sometimes they are all mixed. Such second growth is, however, inconsiderable.

The forests are capable of producing pine—short-leaf, and some white—together with chestnut oak on the slopes and crests; while walnut, yellow poplar, white oak and locust reach a large size in the hollows.

IMPROVEMENT OF THE FORESTS.

A complete cessation of the present annual firing is necessary, not only to insure the possibility of a vigorous stand of young trees, but to afford protection to the standing stock. Pasturage should not be permitted in such portions of the forest as contain young growth that can be injured. Hogs must be excluded after seed-years of nut-bearing trees. As there is now very little merchantable timber on the ridges, all management should have for its object the improvement of the general condition of the forest, regarding both density and preference for the more valuable kinds of trees. Few of the trees on the ridges will form large merchantable stocks; their utilization extends only to small pine milling-timber, oak railway ties, oak and Carolina hemlock tanbark, small chestnut and locust timber for posts and construction.

The trees naturally growing here are light-demanding, except the chestnut, the white oak and white pine, all of which will endure some shade; the chestnut the deepest and the longest, the white pine least and for the shortest time.

The chestnut, chestnut oak and the white oak can be relied on for reproduction from stump and stool-shoots, the chestnut sprouting most vigorously and from the largest-sized stumps, and the white oak least vigorously and from the smallest stumps. The locust frequently sprouts from small stumps, also from suckers under a thin cover.

SHORT-LEAF AND PITCH PINE FORESTS.

The area in which the short-leaf and pitch with the scrub (Jersey) pine are the dominant resinous trees, embraces the basin of the French Broad river in Buncombe and Madison counties, the river-hills of the Swannanoa, those of the French Broad in Henderson county, and the lower hills in Haywood, Swain, Jackson, Macon, Cherokee and Graham counties, lying below an elevation of 2,800 feet above sea level. The surface of this area is broken and rugged, the hills often steep, between them, along the rivers and smaller streams, lying narrow alluvial tracts. The lowest elevations are found on the eroded slopes of the Asheville basin and along the waters of the Little Tennessee river, where at the lowest limits the altitude is not over 2,000 feet.

The upland soils are stiff, mostly even-grained loams, rarely sandy. Although generally deep and derived from disintegration *in situ* of gneiss, or, in Cherokee and Graham counties, slates, they are, on the whole, not fertile; those of the lowlands are rich sedimentary loams with much vegetable matter along the smaller streams; along the larger streams are loams similar to those on the smaller ones, but more sandy and less fertile.

The hills erode rapidly on their shoulders when unprotected. Old fields, however, are generally quickly seeded in native grasses, which form a retentive turf, and after a longer time pines appear.

The short-leaf, pitch and scrub (Jersey) pines are the characteristic conifurs. The broad-leaf trees which grow with them are chiefly the white, black, scarlet and chestnut oaks, chestnut, and hickory. Of these the white oak is first in numbers and importance. It forms from .1 to .5 of the entire forest, being most abundant along the slopes; black oaks and pine superseding it towards the crests; other broad-leaf trees toward the bottoms.

The pines form from .1 to .3 of the forest, being in greatest abundance in the Asheville basin and at the lower elevations.

CONDITION OF THE PINE FORESTS.

The short-leaf and pitch pine forest covers a little more than one-half of the area, and is largely of these pines mixed with broad-leaf trees less than one-twentieth of the forest being pure pine regrowth in old fields. It is divided chiefly among small farms. On the uplands it is decidedly irregular, the cover broken by the indiscriminate removal of mature trees, the young growth beneath representing all ages. Where pastured and burned the forest floor is poor and the young growth not abundant. On the best soils these trees attain an average height of from 60 to 80 feet; on the poorer and along the sandier crests from 50 to 70 feet, the pines being the taller on the poorer soils but being overtopped or equaled in height by the broad-leaf trees in more fertile situations. The density is generally less than three-fourths of what it should be, natural reproduction being prevented by excessive and injudicious lumbering, pasturage, and burning. In many places the mature pines have been largely removed, oaks taking their places, but where there has been no burning many young pines are to be seen. The milling poplar and oak have been largely removed; poplar, from its shade-demanding requirements, the fact that the young plants are eagerly sought for by browsing cattle, and the removal to a great extent of the seed-bearing trees, is reproducing itself only to a limited degree; the chestnut, the white oak, black oak, and scarlet oak more freely.

Where the woodland has been protected for a great many years the mature timber shows little damage from fires or the effects of pasturing; there are only a few localities, however, where this is the case. Black oaks and chestnuts often have hollows from fires; more rarely pines and white oak.

The merchantable timber still standing is chiefly valuable as a source of supply for the numerous farms to which the woodland is attached and the small towns lying near them.

At present the forest is about exhausted, so far as the milling

pine and yellow poplar is concerned. Oak and chestnut, though chiefly of a small size, are still to be obtained.

The forest is capable of yielding milling timber, fuel, railway ties, and fencing, for most of which a local market can be found.

IMPROVEMENT OF THE FORESTS

Protection from fire and cattle should be afforded where this is not already done. Defective trees, or those of inferior kinds, which are interfering with young growth beneath them should be removed. Proximity to farms will generally allow this to be done as such wood can be made use of as fuel. The growth should be allowed to thicken up to restore the humus and give the requisite shade.

Most of the land here is too broken to permit clean cuttings without danger of great injury to the soil. Pure growth of pine, on the gentler slopes could, however, be cut without danger of excessive washing. Naturally the forest requires selection cutting.

The pines and yellow poplar require reproduction in all cases from seed. To supply smaller wood for fuel and farm use most of the broad leaf-trees can be reproduced from stool-shoots.

Fields are seeded by pines and to some extent by locust; rarely by nut-bearing trees. The yellow poplar will propagate in thin woods on a damp soil as the seedlings require some shade. The short-leaf is the most valuable of the pines, and though at first not the most rapid-growing, the Jersey or scrub out growing it, should be protected at the expense of the others if it is intended to permit the trees to reach a large size.

WHITE PINE FORESTS.

The woodland in which white pine is the dominant coniferous tree is not extensive, but lies in isolated, small bodies along the crest, and southern and eastern slopes of the Blue Ridge, or on the low hills on the west.

The most extensive forests containing white pine lie in the southeastern part of Ashe county, extending, though interrupted,

up the valley of the South Fork of New river into Watauga county; in the upper valley of the Linville river in Mitchell county; in the valley of the French Broad river in Transylvania county; and in the southern parts of Macon and Jackson counties, at an elevation of 2,800 to 3,800 feet above sea level, extensive forests seldom being found above the higher limit, or perfect individual development attained below the lower. The total area of white pine forest is not over 200,000 acres.

In a few places on the southern slope of the Blue Ridge, particularly along the headwaters of the Elk, Yadkin, and Roaring rivers in Wilkes and McDowell counties, and the upper valley of the Johns river, the white pine is associated with yellow pines as well as with deciduous trees, but the trees are generally short-boled and neither so large nor tall as those growing at a higher elevation to the west of this range.

Single specimens or small groups of trees are locally dispersed in the broad-leaf forests throughout the mountain counties between the limits of altitude given above. Their value, however, is potential rather than actual, since, growing on the thin-soiled crests of ridges and failing to develop clear shafts, they lack the essential requirements of timber trees; but, as possible sources for the dissemination of seed either in denuded land or in thinned woodland, especially where pastured, their utility may become great. Such groups of trees are to be found in Alleghany, Madison, Haywood, and Graham counties, besides in portions of other counties in which bodies of more compact growth occur.

The white pine is generally associated with white, black, red, and less often, scarlet and chestnut oaks, chestnut, and hickory, when growing along the crests or flanks of rolling hills, on coarse, often porous, gravelly, loamy soils; or less frequently with hemlock, sweet and yellow birch, red oak, and pitch pine along moist or wet fluvial deposits on fertile, loamy soils.

CONDITION OF THE WHITE PINE FORESTS.

In some localities these forests have been extensively culled or lumbered; in others, their integrity is as yet scarcely broken. Where they have not been dismembered two groups of trees are

represented: white pine, forming an upper group, from 100 to 150 feet in height, and usually .1 to .3 of the growth; beneath this, a group of deciduous trees of varying height, but rarely over 90 or less than 70 feet, composed chiefly of white, black, and chestnut oak, and chestnut. Of these, white oak is the most abundant.

Where lumbered they are irregular; occasional decrepit white pines overtopping the deciduous growth, which, however, has been cut into only locally; but where around settlements both pine and hardwoods have been culled the entire cover is broken and thin.

One of the effects of pasturing forest lands is that while young plants of deciduous trees have been destroyed, pines have increased; but where burning is practiced, sourwood, scarlet oak, white oak and other vigorous and free sprouters have propagated most rapidly, while pines have diminished.

In a few places a heavy underwood of the great laurel, less commonly of laurel (ivy), grows beneath the deciduous trees, forming a thicket 10 to 15 feet in height, with many crooked stocks rising from the same burly roots. Where this underwood is present the deciduous growth above is usually more open, but browsing cattle have inflicted less damage on young growth of tender-leaf species, and fires are less frequent; the humus is thick and the soil unimpaired.

There are only few farms in the area of white pine forest; probably less than 20 per cent. of the total acreage being under cultivation. In Ashe and Watauga counties the forest is divided chiefly among small farms; in Mitchell and Macon are large areas thinly settled. On the farms the woodland has been more largely culled and pastured, and its density will seldom be above two-thirds of the normal condition.

A few groves of vigorous young pines have sprung up in the fields from the self-sown seed of neighboring forest trees; but such groves are not common. Young pines are increasing in the woodland only to an inconsiderable extent. Much of the bottom land on which this pine grows has already been deforested, and it is probable that all of it will eventually be brought under

cultivation, as the soil is of superior quality and stands tillage better than that of the adjacent hills. The forests on the hills, however, should be regarded as permanent, and care bestowed on them accordingly.

Larger pines, being protected by their thick bark, are damaged only to a slight extent by fires; young ones while the bark is yet smooth are more readily scorched and injured and sometime killed. Oaks and chestnuts show hollows from the effects of fires, particularly along ridges and in dry woods.

MERCHANTABLE TIMBER OF THE WHITE PINE FORESTS

Extensive areas of unlumbered forest still exist in Transylvania, Macon and Mitchell counties. The standing trees will yield fairly good lumber, though it is seldom that over two cuts, 16 feet in length, from which clear boards are obtainable, can be secured from one tree. Smaller bodies yielding a larger proportion of knotty timber are standing in Wilkes, McDowell, and Caldwell counties. Lumbering is in progress in Mitchell, Caldwell, and Wilkes counties.

IMPROVEMENT OF THE WHITE PINE FORESTS.

At the higher altitudes these forests are capable of producing pine milling timber of good quality, large chestnut and oak timber, ties and fencing. At present there is no local market. Below 2,000 feet the pines fail to clear their stocks and the growth is slower, so that very little lumber free from knots can be made from any trunk.

In places where there is young growth, protection from fire and cattle is imperative. Defective seed-bearing pines, which are not seriously interfering with young growth, should be allowed to remain as seed-trees, both in lumbering and where culling is carried on. It is essential that the growth be maintained at the fullest possible density until the young pines have cleared themselves, as otherwise from their tendency towards perfect symmetry in the development of most of the buds into limbs, the boles will be limby and knotty. As the young trees require small growing-space, the crowns standing much lateral compression and

being to a certain extent shade-bearing, the density can scarcely be too great until the trees reach the size of large poles. The rate of height-growth is more rapid than that of any of the associated species, averaging for the first fifty years over a foot of height-growth a year; and for the first ten years nearly 18 inches a year, so that the young trees quickly free themselves from the shade of broad-leaf trees when growing with them.

The white pine seeds many old fields, but not so quickly or thoroughly as the short-leaf pine. In such groves of pure pine the stand should be kept thick and should not be culled until the height-growth is made. If grown in pure wood, selection cutting would best preserve the factors of the locality, but there are many places where clear cutting would be permissible. The proportion of pine in wood mixed with broad-leaf trees can well be increased to twice or even three times what it is at present, as it is the most valuable tree growing on these gravelly hills. The pine begins to seed in abundance when about forty or forty-five years old, and seed are borne abundantly once in 2 or 3 years.

THE FORESTS OF THE HIGHER MOUNTAINS.

These forests embrace all the woodland lying at an elevation above that of the forests of the lower hills and below 5,000 feet. The lower limit of their distribution is about 3,000 feet, but on southern slopes, particularly along the Blue Ridge, the distinctive character of the growth does not appear for several hundred feet above this limit, following closely the isothermal with the variation incidental to changes in moisture in the soil, depth of soil, and its physical characters.

The greater part of the woodland of the counties of Alleghany, Ashe, Watauga, Mitchell, and Yancey is so situated; and in the mountain region to the south of these counties, the woodland lying around the base and on the slopes of the larger mountain masses.

About one-third of the area originally occupied by these forests is now under tillage or in meadow; the rest is more nearly virgin than any other considerable extent of forest to be found in this State. The situation, on steep slopes or rugged declivities,

the distance from large waterways, and the inaccessibility of the region to railways, has rendered it impossible to economically remove any but the most valuable timbers; while difficulty of tillage, and the short growing-season have tended to prevent extensive cultivation of those lands lying above 3,500 feet elevation.

SOILS OF THE HIGHER MOUNTAINS.

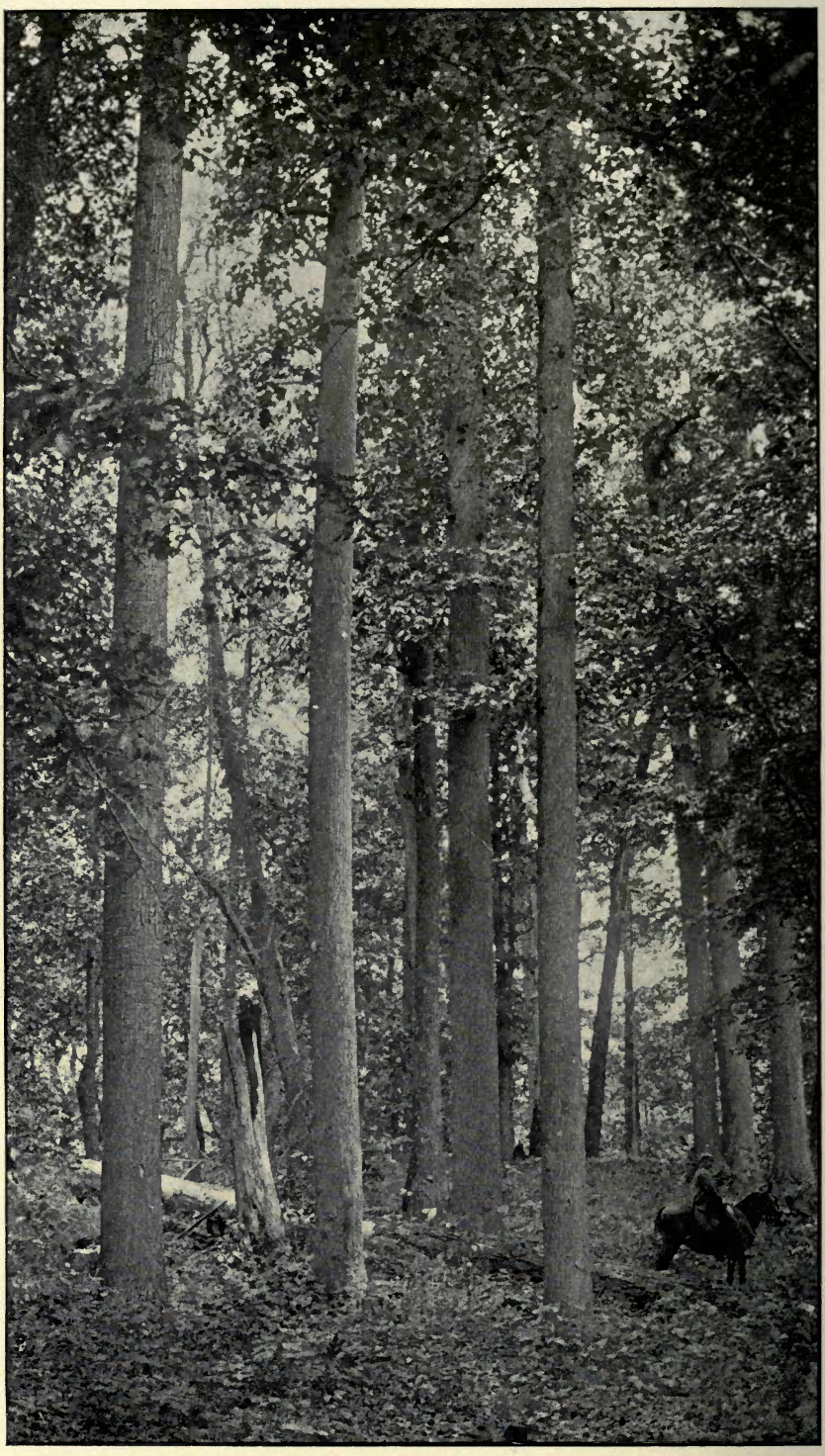
The soils are rather fine and even-grained loams, gray or red in color, or black from organic ingredients; the loamy and generally stiffer sub-soils red or gray. Over the larger part of the area they are derived from the decomposition, *in situ*, of gneiss or gneissic rocks or schists, and are sufficiently deep for tree-growth, particularly along the lower slopes, where detritus washed from above has accumulated or obscurely marked river terraces exist.

In portions of Cherokee and Graham counties, and locally elsewhere, the soils derived from slates, quartzite and metamorphosed sandstones are shallower, thinner and not so favorable to tree-growth. The soils of the upper slopes are thinnest, the clayey particles being more largely washed out, and are sometimes shallow. Those of the sedimentary bottoms are more loamy and coarser, with more organic constituents and less clayey, sometimes underlaid by pipe clay, and ill-drained. The soils of the lower slopes are generally deep and are the most clayey.

FOREST TREES OF THE HIGHER MOUNTAINS.

The forests of the high mountains may be divided into (1) those lying on the crests, and on the slopes facing the south, and (2) those of the north slopes and hollows, and along the bottom lands. The soils of south hill-sides are drier and are thinner than those on slopes with a northerly aspect, and the amount of light and heat is greater than is secured on hill-sides with equal inclination to the north, and the trees are consequently of more light-demanding kinds.

The trees occurring on the slopes facing the north and in the hollows are: hemlock, birches, maples, beech, chestnut, red oak, white oak, great laurel, yellow poplar, white ash, cucumber,



MIXED HARDWOOD FOREST OF THE MOUNTAIN REGION

buckeye. The characteristic trees which are to be found on the northern slopes and hollows are: hemlock, great laurel, sweet birch, yellow birch. (Plate XXIII.)

On the southern slopes and along the gravelly crests of the hills the growth is less varied, being largely composed of chestnut, white oak, red oak, black oak, and chestnut oak. The forest on southern slopes is less dense than on northern and the trees are smaller.

CONDITION OF THE FORESTS.

The cover of these forests has scarcely been broken, the tops of the trees presenting a nearly uniform surface throughout, the crowns closely interlocking and forming a dense shade. Beneath them is a good floor, usually free from grass and weeds and generally with a deep humus.

On the best soils along the lower slopes and bottoms the forests attain an average height of from 90 to 120 feet, with clear shafts of 60 to 90 feet, bearing narrow crowns. On the poorer and thinner soils, particularly towards the upper slopes, the forests become low and less dense, the cover often thin and open, the boles of the trees shorter, generally crooked and knotty, bearing great spreading crowns.

In very many places there are two groups of trees represented in the forest: a dominant arborescent growth of large trees varied as to species and forming the commercially valuable timbers; beneath them a group of evergreen shrubs or under-trees, often of great density, formed of the great rhododendron and laurel. In most places there is present a vigorous young growth of the dominant group of trees if they are shade-bearing species: beech, birch, and hemlock on the wetter soils; sugar maple and occasionally red oak on the drier, the young growth forming thickets, sometimes of pure growth, beneath the parent trees; but where the cover has been broken by trees being removed in lumbering or by windfalls, irregular thickets of light-loving species spring up: chestnut, cucumber tree, yellow poplar, white ash, white and red oaks, which can endure a deep shade only for a short time.

Browsing cattle have damaged young growth to a great extent,

especially such kinds as will not endure, beneath the shade of other trees, repeated cropping: yellow poplar, white ash and oak; sugar maple and beech to a less degree. In many places about fallen trees and the openings made in lumbering, where there would be a heavy young stand, cattle have prevented its growth until thickets of brambles have sprung up within which young seedling trees find protection.

Forest fires have inflicted only slight injury either to standing timber or to young growth on the northern slopes, as the damp or fresh humus does not readily carry fire, but on the south sides much timber has been damaged.

MERCHANTABLE TIMBER OF THE HIGHER MOUNTAINS.

Merchantable trees of walnut and cherry, which have been much sought after for cabinet-making have been nearly all removed. Occasionally large trees of the former kind are to be found, and a few small bodies of the latter still exist upon the higher mountains. Yellow poplar and cucumber-tree, being the chief building materials of the region, have largely been removed; large bodies are still to be found, however, intact, particularly in Yancey, Mitchell, and Transylvania counties, and smaller ones in many other places in the mountains. Floating timbers, white pine, yellow poplar, ash and chestnut have been largely removed from the lower valley of the French Broad to supply mills at Asheville. Oak has been cut nowhere except for local use. The Little Tennessee river and its tributaries have had much of the floating timber removed from them near the water courses. Hemlock has been cut only around Cranberry and adjacent to some of the larger water courses. Ash has been generally removed wherever means of transportation were available. Birch, except curly yellow birch, has never been lumbered, and the same is true of maple, beech, and lin (basswood).

Chestnut has been locally removed. Around all settlements and farming communities a great portion of the oak, chestnut and poplar has been removed, and the forests are much broken.

FOREST INDUSTRIES OF THE MOUNTAIN REGION.

There are mills sawing lumber at Linville, Cranberry, Asheville

and Hot Springs and small ones along and near the railways. The Watauga, Toe, Little Tennessee river and its tributaries afford transportation, the timber going to various places in East Tennessee, chiefly, though, to Knoxville. Hemlock is barked around Cranberry for tanneries at Elizabethton, Tenn., and chestnut oak is barked around Asheville for local tanneries. No use is made of the hemlock stocks after they have been barked; the oak is converted into cordwood and sold for fuel. Walnut, curly ash and curly birch are shipped in the log to veneering factories. The best quality of yellow poplar, ash, and oak timber from here goes chiefly to Philadelphia and Cincinnati, and other inland points, sawn in 8 to 12 inch squares. Locust pins are manufactured at Bryson City, Waynesville and other places. Only a few staves are made and not many white oak railway ties are produced.

In the more remote districts birch oil (*oil of wintergreen*) from the sweet birch is distilled in crude home-made retorts, constructed of wood, lined with clay and with metal bottoms. This was an extensive and profitable industry until overproduction reduced the price. The timber of trees thus barked is rarely used.

Among other smaller industries, which are carried on with more or less profit, are keeping bees, in sections where the sourwood, yellow poplar and lin are abundant, to utilize their flowers for honey; the sale of nuts from the native chestnut; and the manufacture of syrup and sugar from the maples.

THE FORESTS OF THE MOUNTAIN SUMMITS.

The black spruce is the characteristic tree of these forests. With it is generally associated the Carolina balsam, the lower limit of which is about 300 feet above that of the black spruce.

The mountain ash (mountain sumach), striped and spiked maples and wild red cherry are small broad-leaf trees which are usually found growing, though not abundantly, with the balsam and spruce.

These forests of sombre evergreens lie along the summits of the highest mountains, seldom being found on peaks with an elevation of less than 5,500 feet above sea level. They cap the Grandfather and the adjacent pinnacle of the Grandmother; encircle in a great belt the rounded bald of the Roan; stretch along the

numerous massive peaks of the Blacks from Bolen's Pyramid to the Pinnacle; lie on the top of Pisgah; cover the crests and upper slopes of the Great Smoky mountains and the cross-chain of the Balsams as a nearly continuous forest for a distance of almost thirty miles, and crown the tops of the higher peaks of the southern parts of Macon and Jackson counties. From their dark foliage the Blacks and Great Smoky mountains derive their names, and the Balsam mountains from the growth upon them. The lower limits of the forests lie on an average above 5,000 feet above sea level, or a little less. On north slopes, within deep and cool hollows, they extend as low as 4,700 on the Grandfather mountain, 4,600 feet at the head of Caney river in the Blacks, and 4,500 feet at the head of Forney's creek in the Great Smoky mountains, while on bold south slopes, as occur in the Blacks and elsewhere, the broad-leaf trees will often extend as high as 5,300 or 5,500 feet.

Commercially these forests are at present unimportant.

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Walter Mulford

NORTH CAROLINA GEOLOGICAL AND ECONOMIC SURVEY

JOSEPH HYDE PRATT, State Geologist

ECONOMIC PAPER No. 20

WOOD-USING INDUSTRIES OF NORTH CAROLINA

BY

ROGER E. SIMMONS

UNDER THE DIRECTION OF

J. S. HOLMES AND H. S. SACKETT

RALEIGH

E. M. UZZELL & CO., STATE PRINTERS AND BINDERS

1910

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LETTER OF TRANSMITTAL.

CHAPEL HILL, N. C., July 1, 1910.

To His Excellency, HON. W. W. KITCHIN,
Governor of North Carolina.

SIR:—There has just been prepared a report on the Wood-using Industries of North Carolina, which has been compiled by Mr. Roger E. Simmons. This report has been prepared jointly by the North Carolina Geological and Economic Survey and the U. S. Forest Service, and I would recommend that this be published as Economic Paper No. 20 of the reports of the Survey. This report should be of considerable value to the State of North Carolina in forming a forest policy which, if worked out along certain lines, will insure a permanent supply of raw material for our wood-using industries. The report will also be of interest and value to the timber owner, the sawmill operator, and the manufacturers and merchants who handle the finished products.

Yours respectfully,

JOSEPH HYDE PRATT,
State Geologist.

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INTRODUCTORY STATEMENT.

By JOSEPH HYDE PRATT, State Geologist.

The present report deals with the wood-using industries of North Carolina. These may be divided into three classes: (1) those taking timber in the log and by the usual operation of the sawmill converting it into rough lumber; (2) those manufacturing directly from the log a finished product which cannot be changed by any further process of manufacture, such as staves, excelsior, shingles, veneer boxes, or mine rollers; and (3) those using rough lumber and by application of skilled labor and the aid of wood-using machinery converting it into such finished products as furniture, boxes, flooring, etc.

The wood-using industries which come under the first class are not included in this study. Information covering that class is published annually in a statistical report by the Bureau of Census in coöperation with the United States Forest Service, which gives the lumber cut for the country by States and species. The second and third classes, or those industries producing a commodity which cannot be changed by further manufacture, are discussed in this report, and information regarding them has been collected from all sources available. This information has never, heretofore, been made a subject of special investigation in North Carolina. The new forms which further manufacture gives to lumber, and the commodities into which wood enters, are worthy of careful study. The tables given in this report show the sources of such wood used, whether grown in North Carolina or in States nearby or far distant, the kinds of lumber demanded by the woodworking factories, the price paid for each species delivered, the quantity consumed, and the purposes for which it was used.

An investigation of this character should be of value in a number of ways. To the State of North Carolina it should be of considerable assistance in forming an intelligent forest policy, and in presenting the advantages the State offers to wood-using industries to locate in it. The timber owner, and even the farmer who has a few scattered trees to sell, can learn from this report where a market can be found. To the sawmill operator it may suggest a use for wood which he previously considered of little commercial value. To the manufacturer who is under the necessity of looking beyond his own State for all, or part, of the lumber needed, it will furnish a source of fairly accurate information concerning a region most likely to supply his needs. The merchants throughout the country who handle wood products can study to advan-

tage the report of what North Carolina has to sell, or wishes to buy. For the people at large it has a statistical value, and gives much general information.

It gives valuable information concerning the forms, uses, and grades in which the factories desire the lumber, and also the woods most suitable for particular purposes. The chief purposes of this report are to give needed information regarding these industries, to stimulate trade by bringing together buyer and seller, and to show the citizens of North Carolina the wisdom of perpetuating her valuable wood-using industries by the adoption of an intelligent forest policy. Two appendices have been added to this report. The first gives a list of the different kinds of woods that are found in North Carolina, together with the various purposes for which they are used, and the second appendix gives a list of the wood manufacturers of North Carolina under the heads of the products which they manufacture.

The information contained in this report was gathered in the fall of 1909 by the Forest Service of the United States Department of Agriculture and the Forestry Division of the North Carolina Geological and Economic Survey, and these two departments desire to express their thanks to the manufacturers supplying this information, and especially to those who have answered requests for information by mail. The report has been compiled by Mr. Roger E. Simmons, under the supervision of Mr. J. S. Holmes, Forester of the North Carolina Geological and Economic Survey, and Mr. H. S. Sackett of the United States Forest Service.

The value of the timber crop in North Carolina is exceeded only by that of the cotton and corn crops. According to the United States Census Bureau, the value of the lumber-cut of this State amounted in 1908 to $15,000,000.

The following report shows that half of this lumber was purchased by firms in this State and manufactured by them into a finished product. For this lumber, together with a small amount of logs, billets, and timber in other forms which they used, these firms paid something over $10,000,000.

This enormous industry has been dependent for its supply of raw material almost entirely on timber that has grown up under natural conditions, the present owners being in no way responsible or assisting in its production, much of the timber having been growing for 200 to 300 years. As this old timber disappears, as it is rapidly doing, the methods of the producers will have to change, or else one of two things

must happen: either this timber will have to be procured outside the State or these large and valuable industries, second only in importance to cotton manufacture, will have to shut down.

As long as both the growing and the manufacture of this timber can be carried on profitably in this State, we cannot afford to give up either part of this twofold industry. North Carolina probably contains as large a proportion of mountain land specially suitable for the growth of hardwoods, which is what most of these industries require, as any other State. We can, therefore, grow the raw material more cheaply, and furnish it to these factories at a lower price.

This report is intended as an incentive to improvement and as an aid in bringing about better conditions, partly in demonstrating the value of our forests to the people of the State, but chiefly by enlarging the market for the lower grades of wood by letting other parts of the country know what North Carolina can furnish them.

By protecting the forests from fire so that the annual rate of growth can be continually increasing, and by closer utilization, thus preventing waste in the woods and at the mill, there is no reason why the annual yield of our forests cannot after a comparatively short time be doubled.

If as much care and foresight were exercised in the growing, protection, harvesting, and marketing of the raw material as is now given to the manufacture of the finished product, there need be no fear of an impending timber famine on the part of the wood-using industries of North Carolina.

PLATE I. BIRD'S-EYE VIEW IN THE FURNITURE DISTRICT OF HIGH POINT, N. C. THE "GRAND RAPIDS OF THE SOUTH."

WOOD-USING INDUSTRIES OF NORTH CAROLINA.

BY

ROGER E. SIMMONS, UNDER THE DIRECTION OF J. S. HOLMES AND H. S. SACKETT.

INTRODUCTION.

For many years North Carolina has been one of the leading lumber-producing States. Its cut in 1908 exceeded one billion board feet, an amount equaled by only thirteen States. It not only produces a large quantity of rough lumber, but its rating is very high as a manufacturer of finished products. Though there are no means of definitely determining the relative importance of this State among the leading wood-manufacturing States, it is safe to say that few surpass North Carolina in the total amount of the raw material annually consumed in manufacture. It is probable that in no other State in the Union is there so large a percentage of home-grown raw material put into the products of its manufacture. There is converted annually into these products 676,000,000 feet, of which 96 per cent is produced in the State. This amount of material used by the woodworking industries does not include rough lumber in the form of boards, planks, scantling, and structural timber, as these go largely into buildings or other structural work in their rough form. Neither are cross-ties, veneer, cooperage stock, shingles, telegraph and telephone poles included. These are accounted for in special statistics issued annually by the Bureau of the Census, as explained in another part of this report.

KINDS OF WOODS USED.

Thirty-two species of wood, with the amount used and the cost of each at the factory, are presented in Table 1. Where several species of the same genus are all equally suitable for the purpose desired, it was often impossible to get information upon them separately. For instance, white, red, Spanish, and chestnut oak are all acceptable to the furniture manufacturer as raw material. When purchased from local mills, as much of this material is, it was received as "oak," without specifying the particular kinds. In the tables giving information in summary form the general terms of oak, ash, gum, etc., are employed, while in the tables dealing with the individual industries, the exact species are given as reported.

Notwithstanding the heavy drain made for many years on the yellow-pine forests of North Carolina, depleting to a large extent the virgin growth, the amount of this kind of wood consumed by the manufacturers takes the lead over all others. Of the total quantity of yellow-pine

lumber produced in 1908 in this State, according to figures annually compiled, 50 per cent was converted into finished form ready for the consumer. Yellow pine stands first in Table 1 with 62 per cent of the total quantity of all kinds of woods manufactured, followed by oak with 21 per cent, poplar 5.3 per cent, gum 3.2 per cent, white pine 2 per cent, and the other twenty-six species in decreasing amounts. This table shows what percentage of the total quantity grown in and out of the State was supplied by each species. It is interesting to note that of the thirty-two species reported, North Carolina furnished all, or a large part of all, but two. The two foreign woods are mahogany and Circassian walnut. This emphasizes how very important the home supply of lumber is to the people of North Carolina, only 4 per cent coming from outside.

TABLE 1.—SUMMARY OF THE ANNUAL CONSUMPTION OF RAW MATERIAL GROWN IN AND OUTSIDE OF NORTH CAROLINA.

Kind of Wood.	Total Quantity Feet b. m.	Total Cost Delivered at Factory.	Source of Raw Material.	
			North Carolina, Per cent.	Outside of North Carolina, Per cent.
Yellow pine	421,706,000	$5,122,346.65	98.3	1.7
Oak	145,059,000	2,666,669.95	96.6	3.4
Yellow poplar	35,263,000	645,214.95	77.0	23.0
Gum	26,873,000	250,426.41	98.9	1.1
White pine	13,115,000	207,230.28	100.0	
Hickory	11,025,000	273,971.30	53.3	46.7
Chestnut	7,761,000	127,617.80	96.1	3.9
Maple	4,110,000	64,739.80	98.9	1.1
Cypress	2,865,000	41,850.00	97.7	2.3
Locust	2,600,000	36,400.00	100.0	
Ash	1,417,000	36,350.12	99.3	.7
White cedar	1,050,000	16,504.00	100.0	
Dogwood	600,000	11,250.00	100.0	
Black walnut	591,000	24,330.00	30.6	69.4
Birch	513,000	14,147.95	88.9	11.1
Sycamore	369,000	4,110.12	95.9	4.1
Basswood (linn)	265,000	5,500.00	100.0	
Elm	197,000	2,610.00	100.0	
Beech	155,000	3,059.75	100.0	
Persimmon	150,000	3,000.00	100.0	
Spruce	150,000	1,875.00	100.0	
Red cedar	145,000	3,925.00	100.0	
Mahogany	64,250	9,555.29		100.0
Cottonwood	30,000	360.00	100.0	
Cherry	29,000	1,398.00	100.0	
Hemlock	25,000	300.00	100.0	
Kalmia (mountain laurel)	22,000	220.00	100.0	
Butternut (white walnut)	20,000	800.00	100.0	
Cucumber	15,000	180.00	100.0	
Buckeye	10,000	400.00	100.0	
Box elder (Silverbell)	5,000	60.00	100.0	
Circassian walnut	3,000	600.00		100.0
All others*	3,000	240.00		100.0
Totals	676,166,250	9,577,242.37	96.0	4.0

*Includes imported woods not mentioned.

Eighteen of the woods demanded by the various industries are grown entirely in the State. In the case of eight others, 90 per cent is home-grown, while for only one American species is as much as 50 per cent obtained from other States.

HOME-GROWN WOODS USED IN NORTH CAROLINA.

The characteristic growth of the timber, as well as the surface, soil, and other natural conditions, divide the State of North Carolina into three well-known regions, the Coastal Plain, the Piedmont region, and the Mountain region. Table 2 gives the amount in feet consumed in the three regions. Only State-grown wood is considered in this table. The total used by the manufacturers in these regions represents all of the timber grown in North Carolina which goes into finished products. The prices paid for lumber used in these sections, as well as the average price for each kind of wood grown in this State, are likewise shown.

The Coastal Plain region takes approximately 63 per cent of the yellow pine, while the Piedmont region uses only 36 per cent, and the Mountain region 1 per cent. Ninety per cent of the 140,000,000 feet of oak used in the State is manufactured in the Piedmont region; 72 per cent of the gum in the Coastal Plain, and none in the Mountain region; while the Mountain region manufactures most of the spruce and basswood, and uses a greater number of kinds than either of the other regions. The manufacturers in the State use a total of 650,153,000 feet a year of this home-grown material at an average cost per M of $14.13. Of this amount, the Piedmont region takes 53 per cent, the Coastal Plain 44 per cent, and the Mountain region 3 per cent.

It is of as much interest to compare the prices paid in each of the three regions as it is the quantities of material used. Where a wood is indigenous to one region and not to the others, its price is expected to be lower in that region, especially if large amounts of all grades are manufactured. An exception, however, is noted in the case of ash in the Mountain region where it is most abundant, and its price is higher than in the other regions. This difference in price is probably owing to the fact that manufacturers in the different regions demand different grades of this lumber.

TABLE 2.—SUMMARY OF THE ANNUAL CONSUMPTION OF WOODS GROWN IN NORTH CAROLINA.

Kind of Wood.	Coastal Plain Region.		Piedmont Region.		Mountain Region.		State of North Carolina.	
	Quantity, Feet b. m.	Average Cost per M bd. ft. Delivered at Factory.	Quantity, Feet b. m.	Average Cost per M bd. ft. Delivered at Factory.	Quantity, Feet b. m.	Average Cost per M bd. ft. Delivered at Factory.	Total Quantity, Feet b. m.	Average Cost per M bd. ft. Delivered at Factory.
Yellow pine	260,262,000	$ 11.94	151,218,000	$ 12.40	3,601,000	$ 15.66	415,081,000	$ 12.14
Oak	1,437,000	19.80	133,933,000	18.31	4,808,000	10.26	140,178,000	18.05
Yellow poplar	4,372,000	17.03	22,284,000	17.75	499,000	16.33	27,155,000	17.61
Gum	19,895,000	8.14	6,678,000	12.09			26,573,000	9.14
White pine	10,000	27.50	12,565,000	15.67	540,000	18.52	13,115,000	15.80
Chestnut	500,000	19.00	6,061,000	16.31	900,000	16.41	7,461,000	16.50
Hickory	160,000	38.25	4,245,000	24.43	1,475,000	10.40	5,880,000	21.28
Maple	650,000	9.60	3,310,000	17.09	105,000	19.29	4,065,000	15.95
Cypress	2,750,000	13.67					2,750,000	13.67
Locust			2,000,000	14.00	600,000	14.00	2,600,000	14.00
Ash	359,000	23.02	993,000	26.33	55,000	30.00	1,407,000	25.62
White cedar	1,050,000	15.72					1,050,000	15.72
Dogwood			450,000	20.00	150,000	15.00	600,000	18.75
Birch			356,000	28.06	102,000	22.04	458,000	26.72
Sycamore	50,000	7.00	304,000	11.38			354,000	10.76
Basswood (linn)			65,000	32.31	200,000	17.00	265,000	20.75
Elm	175,000	12.75	22,000	18.64			197,000	13.38
Black walnut	40,000	32.00	121,000	44.21	20,000	50.00	181,000	42.15
Beech	135,000	16.74	20,000	40.00			155,000	19.74
Persimmon			150,000	20.00			150,000	20.00
Spruce					150,000	18.75	150,000	18.75
Red cedar			145,000	27.08			145,000	27.08
Cottonwood					30,000	12.00	30,000	12.00
Cherry			2,000	24.00	27,000	48.07	29,000	46.41
Hemlock					25,000	12.00	25,000	12.00
Kalmia (mountain laurel)					22,000	10.00	22,000	10.00
Butternut (white walnut)					20,000	40.00	20,000	40.00
Cucumber					15,000	12.00	15,000	12.00
Buckeye					10,000	40.00	10,000	40.00
Box elder (silverbell)					5,000	12.00	5,000	12.00
Totals	291,845,000		344,947,000		13,359,000		650,151,000	13.83

WOODS GROWN OUTSIDE OF NORTH CAROLINA.

Table 2 treats of the raw material grown in North Carolina, while Table 3 deals with the lumber grown outside of the State. This table gives the quantity of wood used in manufacture, the average cost, delivered at the factory, and the percentage of the different species shipped into the State, grown in the several States mentioned.

The woods brought from outside of the State in 1909 for the wood-using industries aggregated 26,000,000 feet. It is of interest to note that 93 per cent of this quantity is grown in States contiguous to North Carolina. Tennessee ranks first, furnishing 51 per cent; South Carolina, Virginia, and Kentucky follow in the order named, supplying 20, 16, and 6 per cent, respectively. The imported woods amount to little over one-quarter of one per cent of the total. The average price paid for all home-grown material, as shown in Table 2, was $14.13. Table 3, which follows, gives the average cost at the factory of the woods brought from a distance at $26.29, making a difference of $12.16 per M feet in the cost of the woods grown in and out of the State.

A greater quantity of yellow poplar is shipped into North Carolina than any other wood used by the manufacturers. The 8,068,000 feet grown in other States, as shown in the table, is 23 per cent of the total quantity of poplar used. North Carolina pine, following next in the quantity of wood grown outside of the State, is 6,625,000 feet. Two-thirds of this amount is brought from South Carolina, while the remainder is grown in Virginia and Georgia. Sixty-nine per cent of the black walnut used is shipped into the State, and 43 per cent of the hickory. No other wood comes up to these in the relative quantity shipped in. Tennessee and Kentucky furnished most of the hickory.

TABLE 3.—SUMMARY OF THE ANNUAL CONSUMPTION OF WOODS GROWN OUTSIDE OF NORTH CAROLINA.

Kind of Wood.	Quantity, Feet b. m.	Average Cost per M bd. ft. Delivered at Factory.	Percentage Distribution by States.						
			Tennessee.	South Carolina.	Virginia.	Kentucky.	Georgia.	Various States.	Imported.
Yellow poplar	8,068,000	$ 21.26	84.2	5.0	8.1	1.2	1.5		
North Carolina pine	6,625,000	12.80		66.0	31.0		3.0		
Hickory	5,145,000	28.93	65.2		1.3	19.9		13.6	
Red and white oak	4,881,000	27.90	59.1		25.4	8.6	6.7	.2	
Black walnut	410,000	40.73						100.0	
Chestnut	300,000	15.00	66.7		33.3				
Red and tupelo gum	300,000	25.00		100.0					
Cypress	115,000	36.96		100.0					
Mahogany	64,250	147.42							100.0
Birch	55,000	34.73					100.0		
Maple	45,000	33.33	17.8					82.2	
Sycamore	15,000	20.00			100.0				
Ash	10,000	30.00	100.0						
Circassian walnut	3,000	200.00							100.0
All others*	3,000	80.00						33.3	66.7
Totals	26,014,250	26.29	50.9	20.0	15.9	5.9	2.5	4.5	.3

*Includes only imported woods not mentioned.

INDUSTRIES UTILIZING WOOD.

An industry, as it is considered in this report, embraces all manufacturing concerns which produce commodities that are similar or closely related. In North Carolina these may be classified as follows: First, those making commodities in their entirety, ready for the consumer, as baskets, flooring, coffins; second, those manufacturing articles which are component parts of others, as hubs, spokes, or built-up tops; and third, those which take the several parts already manufactured, and merely assemble them to make a finished product. Some vehicle manufacturers are of this class. Table 4, which follows, contains no statistics obtained from the third class, but is compiled from data supplied by classes one and two.

The tendency in manufacturing is toward specialization, and as this becomes more general the number of industries increases, while the products of the separate manufacturers become less varied. Chairs, tables, kitchen safes, furniture, and upholstered furniture are, as a rule, products of different factories. Instead of all of these commodities being the output of a single furniture factory, as was formerly the case, they are separate and distinct industries in North Carolina, and are so treated in this report. This same tendency is seen, also, in other lines of manufacture, such as boxes and agricultural implements.

The manufacturing concerns of North Carolina, as shown in Table 4, are grouped in twenty-one industries. The line of distinction between these was in some cases quite arbitrarily drawn, difficulty being experienced in determining the boundary properly separating those industries whose products are very similar. Take, for example, the industries of flooring, siding, and stock molding; sash, doors, and blinds; and store and office fixtures. The sash and door factories often turn out interior finish of a high character which clearly belongs to the last-named industry. They also manufacture a finish of a class identical with regular stock molding produced by the planing mills of flooring, ceiling, siding, etc., manufacturers. Similar overlappings occur with other industries, making necessary a grouping of the data and its apportionment among the several industries concerned. Where less than three manufacturers producing similar commodities reported, separate classification was impracticable without revealing the information of the concerns reporting. To avoid this, and at the same time include the data in the report, several industries were combined under one heading. Shuttles, spools, bobbins, picker-sticks, and skewers will be found included under the heading of shuttles, spools, bobbins, etc.

Table 4 as presented herewith shows the total amount of raw material used in the State by manufacturers, the average price paid by the industries, the total amount of money invested annually in raw material, and the percentage which each one of these industries used of the total in North Carolina. To what extent the several industries purchase their lumber outside of the State can likewise be determined. It will be noted that this is expressed in approximate percentages of the amounts grown in and outside of North Carolina. Manufacturers of flooring, ceiling, siding, etc., purchased only 1 per cent outside of the State. Vehicle manufacturers purchased 44 per cent in other States, while eleven industries, as will be seen from the table, do not go outside of North Carolina for any of the raw material used.

TABLE 4.—ANNUAL CONSUMPTION OF RAW MATERIAL IN NORTH CAROLINA, BY INDUSTRIES.

Industry.	Quantity.		Cost.		Where Grown.	
	Feet b. m.	Per cent.	Total.	Average per M bd. ft. Delivered at Factory.	In North Carolina, Per cent.	Outside of North Carolina, Per cent.
Table 7. Flooring, ceiling, siding and stock moldings	310,330,000	45.9	$ 3,850,437.90	$ 12.41	99.0	1.0
Table 8. Furniture	100,343,250	14.9	1,828,752.34	18.23	92.6	7.4
Table 9. Boxes, box shooks, and crating	68,063,000	10.1	650,880.98	9.56	97.0	3.0
Table 10. Sashes, doors, blinds, etc.	57,686,000	8.5	783,862.77	13.60	98.9	1.1
Table 11. Chairs	47,325,000	7.0	867,221.70	18.33	97.1	2.9
Table 12. Tables, stands, and extension tables	31,868,000	4.7	543,939.46	17.06	91.7	8.3
Table 13. Trucks, vehicles and wagons	15,636,000	2.3	421,273.43	26.30	56.0	44.0
Table 14. Fruit and vegetable packages (veneer)	8,862,000	1.3	67,805.48	7.65	100.0	----------
Table 15. Insulator pins and brackets	5,600,000	.8	51,400.00	9.18	100.0	----------
Table 16. Coffins, caskets and casket cases	4,775,000	.7	81,599.72	17.09	92.9	7.1
Table 17. Tool and machinery handles	3,595,000	.5	62,193.50	17.30	100.0	----------
Table 18. Shuttles, spools, bobbins, etc.	3,480,000	.5	58,055.30	16.63	100.0	----------
Table 19. Farming implements	3,391,000	.5	40,534.83	11.95	100.0	----------
Table 20. Kitchen safes, cabinets and cupboards	3,325,000	.5	49,698.75	14.95	100.0	----------
Table 21. Cross-arms (telephone and telegraph)	2,816,000	.4	41,282.54	14.66	100.0	----------
Table 22. Pipes, pulleys and mine rollers	2,532,000	.4	21,240.00	17.00	100.0	----------
Table 23. Store and office fixtures, mantels, etc.	2,364,000	.4	81,607.67	34.52	81.2	18.8
Table 24. Musical instruments	1,800,000	.3	44,450.00	24.70	66.7	33.3
Table 25. Boat planking	800,000	.1	11,504.00	14.40	100.0	----------
Table 26. Excelsior	800,000	.1	6,352.00	8.31	100.0	----------
Table 27. Woodenware	775,000	.1	13,150.00	17.00	100.0	----------
Totals	676,166,250	100.0	9,577,242.37	----------	----------	----------

CONSUMPTION BY INDUSTRIES AND REGIONS.

Table 2 presented statistics showing the quantity of raw material grown in the State and used in the Coastal Plain, Piedmont, and Mountain regions of North Carolina. Table 5, which follows, has been compiled to show by industries the total consumption of wood for manufacture in the three regions. The average price paid per M feet, and the percentage of the total quantity of wood used by the various industries in each one of the regions, are also shown. For illustration, the box-makers in North Carolina used 68,063,000 feet of lumber, and 61.5 per cent of it was manufactured in the Coastal Plain, 38.5 per cent in the Piedmont region, and none in the Mountain districts. In figures it stands 41,903,000 feet for the Coastal region and 26,160,000 for the Piedmont. Again, in the sash and door industry the Piedmont region consumes 73.5 per cent, the Coastal Plain 22.3, and the Mountain region 4.2 per cent of the total material used by this industry in the State.

Of the woods used in making flooring, ceiling, siding, boxes, fruit and vegetable packages, farming implements, mine rollers, boat siding, and woodenware, more is consumed in the Coastal Plain than in the other two regions together. In the Piedmont region over 50 per cent of the total quantity of material used by thirteen industries is consumed in making furniture, sashes, doors, and blinds, chairs, tables, vehicles, coffins, and caskets, handles, shuttles, spools and bobbins, kitchin safes and cupboards, cross-arms, store and office fixtures, mantels and interior trimmings, and excelsior. The one remaining industry, manufacturing insulator pins and brackets, consumes in the Mountain region 64 per cent of wood entering into these products.

There are 676,166,250 feet of raw material going into manufactured articles annually in North Carolina, and of this total 43.9 per cent is used by the industries located in the Coastal Plain region, 54.2 per cent by the manufacturers in the Piedmont section, and 1.9 per cent by those of the Mountain region. Nearly six million dollars is expended annually in the Piedmont region for raw material delivered at the factory, three and one-half million is spent in the Coastal Plain, and less than two hundred thousand dollars in the Mountain region. This absence of wood-using industries in the mountains is accounted for chiefly by the lack of transportation facilities, which has existed in this region until quite recently, and the consequent cost of getting timber to market. The higher grades, which are the only ones that can profitably be hauled over these mountain roads any considerable distance, are usually shipped to the northern and western markets. With improved roads, however, and additional railroads, there is no reason why the Mountain region should not manufacture the greater part of its own raw material.

TABLE 5.—ANNUAL CONSUMPTION OF RAW MATERIAL IN NORTH CAROLINA, BY INDUSTRIES AND REGIONS.

Industry.	Coastal Plain Region.			Piedmont Region.			Mountain Region.		
	Quantity.		Cost.	Quantity.		Cost.	Quantity.		Cost.
	Feet b. m.	Per cent.		Feet b. m.	Per cent.		Feet b. m.	Per cent.	
Flooring, ceiling, siding and stock moldings	217,690,000	70.1	$ 2,714,793.80	90,360,000	29.1	$ 1,099,216.60	2,280,000	.8	$ 36,427.50
Furniture	3,751,000	3.7	56,375.86	94,401,250	94.2	1,739,148.20	2,191,000	2.1	33,228.28
Boxes, box shooks and crating	41,903,000	61.5	357,391.58	26,160,000	38.5	293,489.40			
Sashes, doors, blinds, etc.	12,883,000	22.3	160,642.65	42,407,000	73.5	581,676.88	2,396,000	4.2	41,543.24
Chairs	250,000	.5	3,500.00	47,075,000	99.5	863,721.70			
Tables, stands and extension tables	20,000	(a)	300.00	31,141,000	97.7	532,187.38	707,000	2.3	11,452.08
Trucks, vehicles and wagons	2,381,000	15.2	61,546.81	13,255,000	84.8	359,726.62			
Fruit and vegetable packages (veneer)	8,862,000	100.0	67,805.48						
Insulator pins and brackets				2,000,000	35.7	28,000.00	3,600,000	64.3	23,400.00
Coffins, caskets and casket cases	2,160,000	45.2	30,287.52	2,615,000	54.8	51,312.20			
Tool and machinery handles				2,120,000	58.8	46,873.20	1,475,000	41.2	15,320.30
Shuttles, spools, bobbins, etc.				3,150,000	90.8	54,003.60	330,000	9.2	4,051.70
Farming implements	2,950,000	86.9	31,351.45	416,000	12.3	8,683.38	25,000	.8	500.00
Kitchen safes, cabinets and cupboards				3,325,000	100.0	49,698.75			
Cross-arms (telephone and telegraph)	250,000	8.9	4,375.00	2,566,000	91.1	36,907.54			
Pipes, pulleys and mine rollers	2,510,000	99.1	21,020.00				22,000	.9	220.00
Store and office fixtures, mantels, etc.	66,000	3.9	1,320.00	1,750,000	74.0	62,940.77	548,000	22.1	17,346.90
Musical instruments				1,800.000	100.0	44,450.00			
Boat planking (worked)	800,000	100.0	11,504.00						
Excelsior				800,000	100.0	6,352.00			
Woodenware	650,000	84.0	11,200.00	25,000	3.3	450.00	100,000	12.7	1,500.00
Totals	297,126,000	43.9	3,533,414.15	365,366,250	54.2	5,858,838.22	13,674,000	1.9	184,990.00

(a) Less than one-tenth of one per cent.

FORM, GRADE, AND SIZES OF RAW MATERIAL.

In the foregoing tables and discussions the raw material used in North Carolina has been considered, first, as to quantity and species, and then as to industries. Table 6 treats of the raw material from a different standpoint, presenting the forms desired, the grades in which it is purchased, and the range of sizes acceptable. For instance, by consulting the table it can be learned that seventy-three concerns are classified under furniture. The material purchased by them is all in the form of rough-sawed lumber. Forty-five of these firms purchased log-run grades, while twenty-eight report buying established grades. The sizes of rough lumber purchased by the furniture makers range in thickness from $\frac{3}{4}$ to $\frac{4}{4}$, $\frac{5}{4}$ or 1 inch being the size most commonly used. As in other industries, the fact of the furniture manufacturers buying a portion of their raw material in the form of rough-sawed squares is indicated in the table by the asterisk (*). The smallest sizes in lumber purchased by any of the manufacturers making up the several industries can be seen from the last column of the table. This does not include squares.

That the manufacturers in North Carolina are located near the source of timber supply accounts for the fact that thirteen out of the twenty-one industries listed in the table secure all or some portion of their raw material in log form, seventeen report using rough-sawed lumber as raw material, while nine industries used billets or bolts from which to manufacture their products. See Plates II and III.

Owing to the incomplete data supplied by many of the firms reporting, these statistics do not present the matter in the definite form originally intended by this study. In its present shape, however, this report contains much useful information. It should help those wishing to sell their timber by acquainting them with the form in which each different industry desires raw material, whether in logs, in bolts, or in rough-sawed lumber. Where the raw material is rough lumber they can get some idea of the sizes used and the grades which will be received, whether log-run or established grades. A sawmill operator can learn what industries use sawed squares. By the addition of a rip and cut-off saw to his machinery he can manufacture squares from the inferior lumber that would otherwise be waste.

It will be noticed that many of the industries using rough lumber buy it in log-run rather than in established grades. This custom doubtless operates to the disadvantage of both the lumberman and the wood user. The lumberman could saw the lower grades into squares, and, grading his best lumber according to grading rules, would realize more for the

PLATE II. MILL AND YARD OF GOLDSBORO LUMBER COMPANY, DOVER, N. C. MANUFACTURERS OF HIGH-CLASS FLOORING, CEILING, SIDING AND MOLDING. THE PINE LOGS IN THE FOREGROUND ARE READY TO BE SAWED.

TABLE 6.—NUMBER OF FIRMS, AND FORM, GRADE, AND SIZE OF RAW MATERIAL REQUIRED.

Industry.	Number of Firms Reporting.	Form of Raw Material (in percentage of quantity).			Firms Buying Lumber.		Size of Raw Material Required.			Smallest Size Reported of Raw Material Purchased.
							Ranging—		Principally.	
		Logs, Per cent.	Bolts and Billets, Per cent.	Lumber, Per cent.	Mainly Log-run, Number.	Mainly in Established Grades, Number.	From—	To—		
Flooring, ceiling, siding and stock moldings	136	59.3	----------	40.7	83	53	4–4	10–4	4–4	1″x3″–8′
Furniture	73	----------	----------	100.0*	45	28	3–4	16–4	4–4	1″x3″–10′
Boxes, box shooks and crating	46	26.7	----------	73.3	28	18	3–8	6–4	4–4	1″x3″–6′
Sashes, doors, blinds, etc.	72	17.2	----------	82.8	28	44	4–4	16–4	4–4	1″x4″–6′
Chairs	30	11.2	----------	88.8*	10	20	4–4	10–4	Squares.	1″x3″–10′
Tables, stands and extension tables	20	3.7	----------	96.3*	13	7	3–4	16–4	4–4 Lumber and squares.	1″x4″–any.
Trucks, vehicles and wagons	34	11.0	----------	89.0*	4	30	3–8	12–4	Variable.	1″x4″–8′
Fruit and vegetable packages	15	68.7	31.3	----------	----------	----------	6″ diam.	and up.	12″ logs.	1″x4″–8′
Insulator pins and brackets	3	35.0	20.0	45.0*	----------	3	----------	----------	Squares.	
Coffins, caskets and casket cases	7	10.5	----------	89.5	3	4	4–4	8–4	4–4	1″x4″–8′
Tool and machinery handles	10	5.8	68.2	26.0*	----------	10	----------	----------	Squares.	
Shuttles, spools, bobbins, etc.	7	----------	55.8	44.2*	----------	7	----------	----------	Squares.	
Farming implements	6	----------	19.6	80.4*	1	5	4–4	12–4	Variable.	1″x4″–8′
Kitchen safes, cabinets and cupboards	5	----------	----------	100.0	1	4	4–4	10–4	4–4	1″x4″–10′
Cross-arms (telephone and telegraph)	3	----------	16.8	83.2*	----------	3	----------	----------	Squares.	
Pipes, pulleys and mine rollers	4	70.4	29.6	----------	----------	----------	6″ diam.	and up.	12″ logs.	
Store and office fixtures, mantels, etc.	18	----------	----------	100.0*	----------	----------	3–4	10–4	4–4	1″x6″–10′
Musical instruments	3	----------	----------	100.0*	1	2	3–4	12–4	4–4	1″x3″–6′
Boat planking (worked)	3	100.0	----------	----------	----------	----------	8″ diam.	and up.	Logs.	6″ diameter.
Excelsior	3	----------	100.0	----------	----------	----------	3″ diam.	and up.	Split billets.	3″ diameter.
Woodenware	3	45.7	25.7	28.6	2	----------	6″ diam.	and up.	Logs.	6″ diameter.

*Purchase portion of lumber in form of "rough-sawed squares."

output of his mill than by selling the material in log-run form. The manufacturer would be relieved of the trouble of sawing the inferior grades into squares at the factory, and of the expense of paying for transportation, handling, and culling this log-run material, a large percentage of which will be a waste on his hands. The percentage of lumber suitable for further manufacture varies considerably in each consignment where materials are purchased in log-run grades. This brings about an element of uncertainty and often misunderstanding which can partly be eliminated if the lumber be purchased according to grades, and the squares according to specifications.

FLOORING, CEILING, SIDING, ETC.

So usual is it for sawmills in yellow-pine regions to market a large part of their cut in the form of flooring, ceiling, etc., that the public generally associates these products with the output of sawmills. The items in Table 7 represent that portion of the lumber produced by sawmills which, with the aid of planing-mill machinery, is converted into flooring, ceiling, siding, wainscoting, partitions, stock moldings, and casings. Roofers, box lumber, and boards merely surfaced are not considered as a part of these figures, as it is possible for these to be utilized later in the manufacture of other commodities. This table was compiled from statistics furnished by the sawmills which have planing-mill departments, but it includes, also, data furnished by the planing mills throughout the State which do not operate sawmills, but buy their lumber. Plate II.

This industry is the largest in the State, based on the quantity of wood used. Forty-five per cent of all the wood manufactured in North Carolina goes to these factories. The amount of money representing this raw material is over one-half of that expended by all the wood-using industries collectively. One-third of the number of wood users of all kinds in North Carolina are engaged in this industry.

By referring back to Table 6 it will be seen that more than half of the flooring, ceiling, and siding is produced by the same firm which cuts the rough lumber from the log from which these products are manufactured.

Yellow pine heads the list of species for quantity. It is the most abundant wood in the State, and the North Carolina manufacturers of these products use over fifty times as much of it as of all other woods combined. It enters into all the products of the flooring, ceiling, and siding industry, while yellow poplar is devoted mostly to the manufacture of siding and moldings. Cypress, being especially suitable for outdoor work, is used largely for porch flooring. Maple and oak are used in nominal amounts and are converted into flooring and inside trimming.

The proportion of each kind of wood used in this industry to the total of that wood used in the State is seen by consulting the last column of Table 7. This shows that 72.4 per cent of all the yellow pine manufactured in North Carolina is converted into flooring, ceiling, siding, etc., while 87 per cent of the cypress is taken by this industry, and 7 per cent of the poplar.

TABLE 7.—FLOORING, CEILING, SIDING, AND STOCK MOLDING.

Kind of Wood.	Grown in North Carolina.		Grown Outside of North Carolina.		Total Quantity of Raw Material Used Annually.			Percentage of Quantity Required by All Industries in State.
	Quantity, Feet b. m.	Average Cost per M bd. ft. Delivered at Factory.	Quantity, Feet b. m.	Average Cost per M bd. ft. Delivered at Factory.	Quantity, Feet b. m.	Average Cost per M bd. ft. Delivered at Factory.	Total Cost Delivered at Factory.	
North Carolina and longleaf pine	302,075,000	$ 12.35	3,050,000	$ 13.48	305,125,000	$ 12.37	$ 3,775,717.90	72.40
Cypress	2,400,000	14.00			2,400,000	14.00	33,600.00	87.00
Yellow poplar	2,375,000	13.86			2,375,000	13.86	32,917.50	7.00
Red and white oak	400,000	17.85			400,000	17.85	7,140.00	.27
Hard maple			25,000	40.00	25,000	40.00	1,000.00	.60
Chestnut	5,000	12.50			5,000	12.50	62.50	.06
Totals	307,255,000	12.38	3,075,000	13.70	310,330,000	12.41	3,850,437.90	

FURNITURE.

The furniture industry, as here considered, includes bedroom suits and odd pieces like chiffoniers, dressing-tables, shaving-stands, sofas, hall racks, settees, lounges, sideboards, buffets, china closets, plate racks, music cabinets, piano stools and benches, parlor cabinets, etc. Chairs, tables, and kitchen safes are not included in this table, the manufacture of these being treated as separate industries. Had all furniture making been grouped in one industry, the 100,000,000 feet shown in Table 8 would be increased to 183,000,000 feet, while the total annual expenditure for raw material would aggregate $3,240,000. This emphasizes the importance of the various branches of furniture making in North Carolina.

In the quantity of material used, as well as in its cost, furniture is second among the wood-using industries of the State. Fifteen per cent of the wood used in the State for manufacturing purposes goes into furniture, and 45 per cent into flooring, ceiling, siding, etc. The furniture makers paid an average price of $18.23 per M feet, which was 50 per cent higher than that paid for raw material consumed by the flooring, ceiling, siding, etc., industry. See Plates I and III.

Only 7½ per cent of the 100,000,000 feet of lumber used by the furniture manufacturers is grown outside of North Carolina. Sweet birch comes from Michigan and mahogany is imported; the remainder of that which is shipped into this State, including poplar, chestnut, and gum, comes from neighboring States.

The quantity of oak used was more than three times the amount of any other wood reported. Of this white oak leads in quantity, red oak follows, and Spanish oak is least. The best grades of oak are used for the outside of furniture, the lower grades for frame work and cores for veneering. The price paid for home-grown oak was $18.41 per M feet. That shipped in cost $10.47 more per M feet. The imported oak included much quarter-sawed oak. Fifty per cent of the oak shipped into the State for all purposes is taken by furniture manufacturers.

Yellow poplar comes second in importance in the manufacture of furniture. More yellow poplar is brought into the State by this industry than all other species combined. Furniture manufacturers pay $1.51 per M feet less for home-grown poplar than for that bought in other States. The total amount of this wood used for furniture is 19,000,000 feet, a little more than 1 per cent of all the poplar manufactured in the State.

In relative quantity of wood used North Carolina pine comes third on the list in this industry. The amount used, however, is less than

one-third that of yellow poplar, and one-tenth that of the oak. Its use is chiefly for the inside of furniture and for veneer cores. The average cost per M feet was $14.61 in this industry.

Seventeen per cent of the total amount of chestnut and the same proportion of the total amount of white pine used for all purposes of manufacture in North Carolina were used in this industry. Black walnut is not reported in the State by furniture makers, and mahogany is the only imported wood reported, a portion of which was purchased in the form of veneering. The average cost of mahogany delivered at the factory was $159.21 per M feet.

PLATE III. MAIN FLOOR OF THE FACTORY OF THE SOUTHERN CHAIR COMPANY, HIGH POINT, N. C.

TABLE 8.—FURNITURE (GENERAL).

Kind of Wood.	Grown in North Carolina.		Grown Outside of North Carolina.		Total Quantity of Raw Material Used Annually.			Percentage of Quantity Required by All Industries in State.
	Quantity, Feet b. m.	Average Cost per M bd. ft. Delivered at Factory.	Quantity, Feet b. m.	Average Cost per M bd. ft. Delivered at Factory.	Quantity, Feet b. m.	Average Cost per M bd. ft. Delivered at Factory.	Total Cost Delivered at Factory.	
Oak	63,331,000	$ 18.41	2,556,000	$ 28.88	65,887,000	$ 18.41	$ 1,239,748.00	45.42
Yellow poplar	14,526,000	17.10	4,428,000	18.61	18,954,000	17.20	332,189.00	1.40
North Carolina pine	5,970,000	14.61			5,970,000	14.61	86,221.70	1.40
Chestnut	4,555,000	15.60	100,000	15.00	4,655,000	15.60	72,558.00	16.90
White pine	2,210,000	18.28			2,210,000	18.28	40,398.80	16.90
Red and tupelo gum	1,415,000	17.36	300,000	25.00	1,715,000	19.28	33,064.40	7.03
Maple	325,000	18.22			325,000	18.22	5,921.50	8.00
White ash	258,000	20.85			258,000	20.85	5,379.30	18.20
Sycamore	104,000	14.04			104,000	14.04	1,460.16	28.20
Beech	75,000	22.13			75,000	22.13	1,659.75	48.40
Birch	71,000	21.00	55,000	34.73	126,000	28.30	3,401.00	24.60
Mahogany			39,250	159.21	39,250	159.21	6,250.00	61.10
Basswood	25,000	20.00			25,000	20.00	500.00	9.40
Totals	92,865,000	17.81	7,478,250	23.37	100,343,250	18.23	1,828,752.34	

BOXES AND CRATES.

As each year the virgin stands of timber in North Carolina approach nearer to exhaustion the sawmill man seeks to supply his demands more and more from the second and even the third growths of timber. This necessity has become well-nigh universal in the yellow-pine districts, resulting in a considerable increase in the quantity of the lower grades of lumber. The necessity for utilizing these lower grades is, no doubt, one of the chief factors in developing, in North Carolina, the manufacture of boxes. There is a grade of yellow-pine lumber which is known to the trade as "boxing"; this, however, is not included in these statistics. The figures and items in Table 9 refer to material actually consumed in the making of boxes and crates by the several woodworking industries of the State. The box manufacturers use over 68,000,000 feet of timber annually, making this industry third in the State for quantity used. The cost of the material was $651,000, an average price of $9.56 per M feet. All the material going into boxes and box shooks is supplied by North Carolina, excepting 2,000,000 feet, which is reported grown in South Carolina at $1 more per M feet than the home-grown yellow pine. North Carolina pine makes up two-thirds of the box material, while gum is second in importance. For exportations, especially to South Africa and Australia, gum boxes are in great demand. The trade to these foreign countries contends that goods sell more readily in packages made of this material. This has brought about an increasing demand for gum box shooks, and accounts for the fact that 54½ per cent of all the gum consumed in the State of North Carolina is manufactured into these products. White pine is also an important wood for the box makers, who use 47 per cent of all this wood purchased by the manufacturers in the State. A fourth of the box makers in North Carolina cut their material from the log, and the industry is becoming closely allied with the large sawmills which are striving more and more to put to some use those grades of lumber that would otherwise go to waste. Boxes and box shooks are not all made of the lower grades of lumber, as they must vary in price and grade according to use. Some high-priced boxes require the best grades of lumber, such as trunks, sample cases, and packages designed for the shipment of goods of fine textures where the exclusion of moisture and dust is of prime consideration.

TABLE 9.—BOXES, BOX SHOOKS, AND CRATING.

Kind of Wood.	Grown in North Carolina.		Grown Outside of North Carolina.		Total Quantity of Raw Material Used Annually.			Percentage of Quantity Required by All Industries in State.
	Quantity, Feet b. m.	Average Cost per M bd. ft. Delivered at Factory.	Quantity, Feet b. m.	Average Cost per M bd. ft. Delivered at Factory.	Quantity, Feet b. m.	Average Cost per M bd. ft. Delivered at Factory.	Total Cost Delivered at Factory.	
North Carolina pine	43,227,000	$ 9.12	2,000,000	$ 10.38	45,227,000	$ 9.17	$ 414,980.24	10.70
Red and tupelo gum	13,301,000	8.21			13,301,000	8.21	109,201.21	54.57
White pine	6,210,000	13.18			6,210,000	13.18	81,847.78	47.40
Yellow poplar	2,526,000	14.75	50,000	17.00	2,576,000	14.79	38,101.75	12.20
Maple	500,000	8.50			500,000	8.50	4,250.00	12.20
Cypress	250,000	10.00			250,000	10.00	2,500.00	9.04
Totals	66,014,000	9.53	2,050,000	10.54	68,064,000	9.56	650,880.98	

SASH, DOORS, BLINDS, ETC.

The makers of sash, doors, and blinds often manufacture inside and outside finish for buildings. The industry differs from that which turns out flooring, ceiling, stock molding, and siding, in that it calls for more complicated machinery and usually requires labor of greater skill. Special designs are frequently required, and each must be worked out with judgment and care. Stairways, newel and landing posts, archways, special wainscoting, casing and moldings to order, store fronts, cornice work, porch work, brackets, and spindles, are illustrations.

Fourteen kinds of wood are demanded by the sash and door factories of North Carolina, and 57,600,000 feet are used yearly, which is more than 8½ per cent of all the wood manufactured in the State. Yellow pine, which includes North Carolina pine and some longleaf, leads the list in quantity and cost. The quantity is 85 per cent of the total wood used by this industry, of which 1,000,000 feet, mainly longleaf pine, was shipped into the State from South Carolina. The imported pine cost about $1 per M feet more than that grown in North Carolina. White pine is next in quantity and constitutes 27 per cent of all the white pine manufactured in the State. It is all grown in North Carolina and, as shown in the table, was purchased at an average price of $17.95, delivered at the factory. The price paid for yellow poplar recorded in Table 10 was $2.09 more per M feet than was paid by the flooring, ceiling, siding, etc., manufacturers, and $1.25 less than the price paid by the furniture makers. Spruce, purchased at $12.50 per M feet, cottonwood, cucumber, and box elder, at $12 per M feet, were not reported for any other industry in North Carolina. This industry demanded 35,000 feet of ash, which was one-fourth of all reported in the State.

TABLE 10.—SASH, DOORS, BLINDS, AND INTERIOR FINISH (MILL WORK).

Kind of Wood.	Grown in North Carolina.		Grown Outside of North Carolina.		Total Quantity of Raw Material Used Annually.			Percentage of Quantity Required by All Industries in State.
	Quantity, Feet b. m.	Average Cost per M bd. ft. Delivered at Factory.	Quantity, Feet b. m.	Average Cost per M bd. ft. Delivered at Factory.	Quantity, Feet b. m.	Average Cost per M bd. ft. Delivered at Factory.	Total Cost Delivered at Factory.	
North Carolina pine	50,636,000	$ 12.71	1,000,000	$ 13.60	51,636,000	$ 12.90	$ 665,791.68	12.30
White pine	3,525,000	17.95			3,525,000	17.95	63,273.75	26.90
Yellow poplar	835,000	15.95			835,000	15.95	13,318.25	2.40
Red and white oak	668,000	26.88	90,000	40.00	758,000	28.43	21,555.84	.52
Chestnut	386,000	17.30			386,000	17.30	6,677.80	5.00
Spruce	150,000	12.50			150,000	12.50	1,875.00	100.00
Basswood	100,000	18.00			100,000	18.00	1,800.00	38.00
Yellow birch	95,000	36.82			95,000	36.82	3,599.55	18.50
Cypress			60,000	50.00	60,000	50.00	3,000.00	2.20
Red and tupelo gum	56,000	16.00			56,000	16.00	896.00	.23
Ash	35,000	42.14			35,000	42.14	1,474.90	2.47
Cottonwood	30,000	12.00			30,000	12.00	360.00	100.00
Cucumber	15,000	12.00			15,000	12.00	180.00	100.00
Box elder	5,000	12.00			5,000	12.00	60.00	100.00
Totals	56,536,000	13.51	1,150,000	17.57	57,686,000	13.60	783,862.77	

CHAIRS.

Table 11 gives statistics of chair manufacturing in North Carolina. From the standpoint of the retail merchant and the consumer chairs are considered furniture, but from the point of view of the manufacturer they are considered separate and distinct. Chairs of practically all kinds are made in North Carolina—reclining chairs, rockers, patent rockers, diners, morris chairs, hall chairs, porch chairs, official chairs for lodge-rooms, and stools of many kinds. Chair stock shipped into the State in a knocked-down condition, to be assembled and finished after its arrival here, was not included in this report, nor was any information turned in from upholstering concerns. See Plates III and IV.

The chair industry is fifth in importance in North Carolina from the standpoint of the amount of wood used, and, as in the case of furniture making, is confined almost exclusively to the Piedmont region. Only 250,000 feet out of a total of 47,325,000 used by chair makers in the State is consumed outside the borders of this region. Seven kinds of woods are reported used in this industry. Oak, of the same species as are used in furniture manufacturing, represents 97 per cent of the total quantity of raw material demanded by this industry. It is one-third of all the oak used by manufacturers in the State. Maple, yellow poplar, and hickory, in the order named, follow oak in quantity used. Only 3 per cent of the chair material is grown outside of the State. Fifty-eight per cent of the chair-making concerns buy a portion of their raw material in the form of rough-sawed squares. This is of importance to mill men, who can make use of waste by sawing it in squares of suitable dimensions.

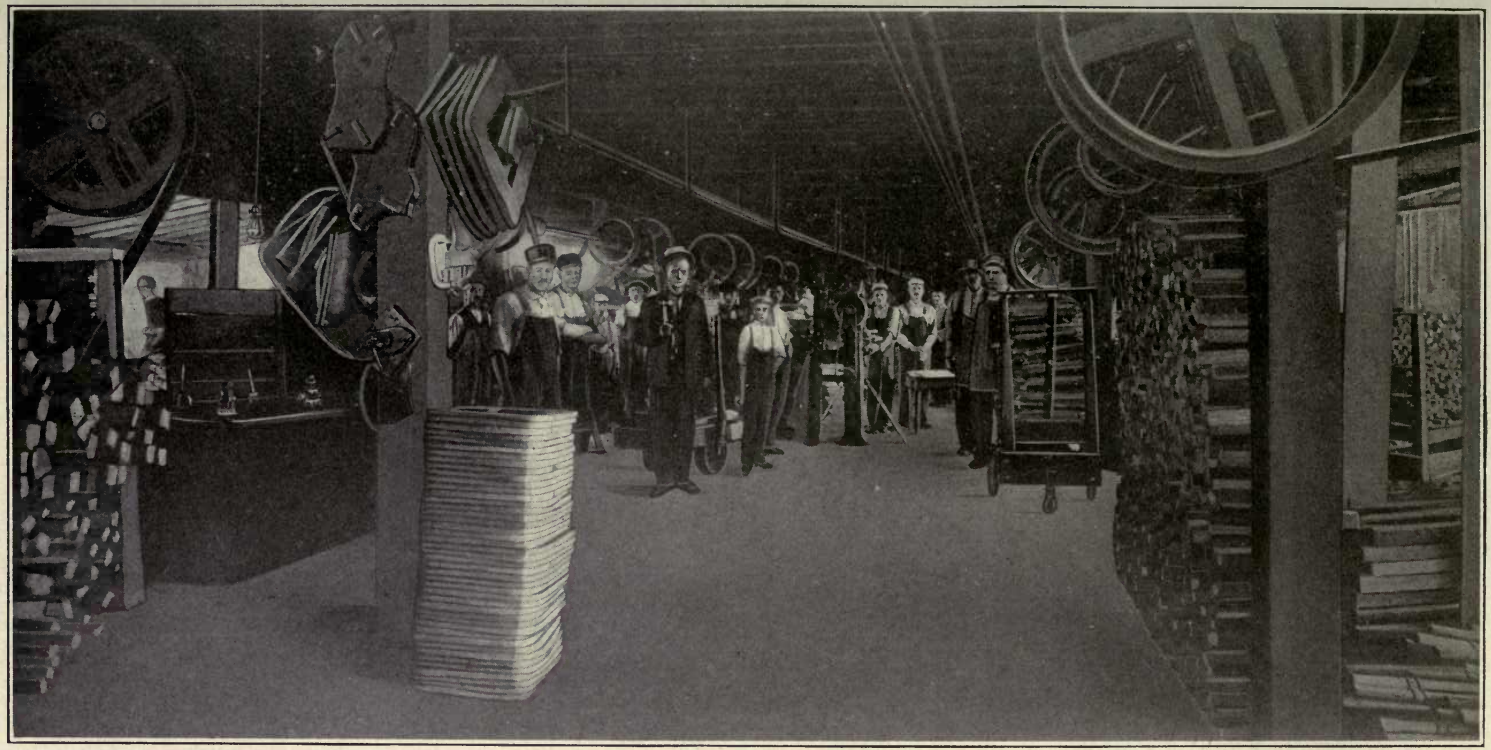


PLATE IV. TURNING ROOM OF THE SOUTHERN CHAIR COMPANY, HIGH POINT, N. C.

TABLE 11.—CHAIRS, ROCKERS, AND RECLINING CHAIRS.

Kind of Wood.	Grown in North Carolina.		Grown Outside of North Carolina.		Total Quantity of Raw Material Used Annually.			Percentage of Quantity Required by All Industries in State.
	Quantity, Feet b. m.	Average Cost per M bd. ft. Delivered at Factory.	Quantity, Feet b. m.	Average Cost per M bd. ft. Delivered at Factory.	Quantity, Feet b. m.	Average Cost per M bd. ft. Delivered at Factory.	Total Cost Delivered at Factory.	
Red, white, chestnut and Spanish oak	43,955,000	$ 17.91	1,150,000	$ 27.80	45,105,000	$ 18.16	$ 819,183.05	31.09
Hard maple	830,000	20.23			830,000	20.23	16,790.90	20.20
Yellow poplar	475,000	23.27	220,000	25.45	695,000	24.00	16,653.25	2.00
Hickory	585,000	21.70			585,000	21.70	12,694.50	5.30
Red gum	50,000	12.00			50,000	12.00	600.00	.21
Birch	50,000	22.50			50,000	22.50	1,125.00	9.70
Elm	10,000	17.50			10,000	17.50	175.00	5.10
Totals	45,955,000	18.05	1,370,000	27.41	47,325,000	18.33	867,221.70	

TABLES.

The manufacture of tables in North Carolina is in itself a large industry, entirely distinct from that of furniture making. Like furniture and chairs, the manufacturers making tables are located mostly in the Piedmont region of the State. Every kind of table from the cheapest for kitchen use to the most elaborately carved parlor and library table is manufactured. Table 12 shows that 31,868,000 feet of lumber, or 5 per cent of the total consumed in manufacturing in the State, were used, at an average cost of $17.06 per thousand. Red, white, Spanish, and chestnut oak, aggregating 21,947,000 feet, head the list of woods for this industry. The wood is all grown in North Carolina and is 15 per cent of the total oak used by manufacturers in this State. Longleaf and North Carolina pine are next in importance to oak for the manufacture of tables. This, too, was State grown, and 4,520,000 feet were purchased at an average of $13.14 per thousand. Of the 4,000,000 feet of poplar going into tables, 65 per cent is shipped in from neighboring States, Tennessee furnishing the larger portion of it. The average price for poplar in this industry was $20.96, which is $3.76 more than was paid for this wood by furniture manufacturers. Chestnut, which stands next to poplar in quantity, is used mostly for cores in making built-up table tops; 1,000,000 feet was reported, which was 13 per cent of the total chestnut manufactured in North Carolina. The remaining species named in the following table are used in very nominal quantities and range in price from $16 per M feet for basswood to $120 per M for mahogany.

TABLE 12.—TABLES, STANDS, AND EXTENSION TABLES.

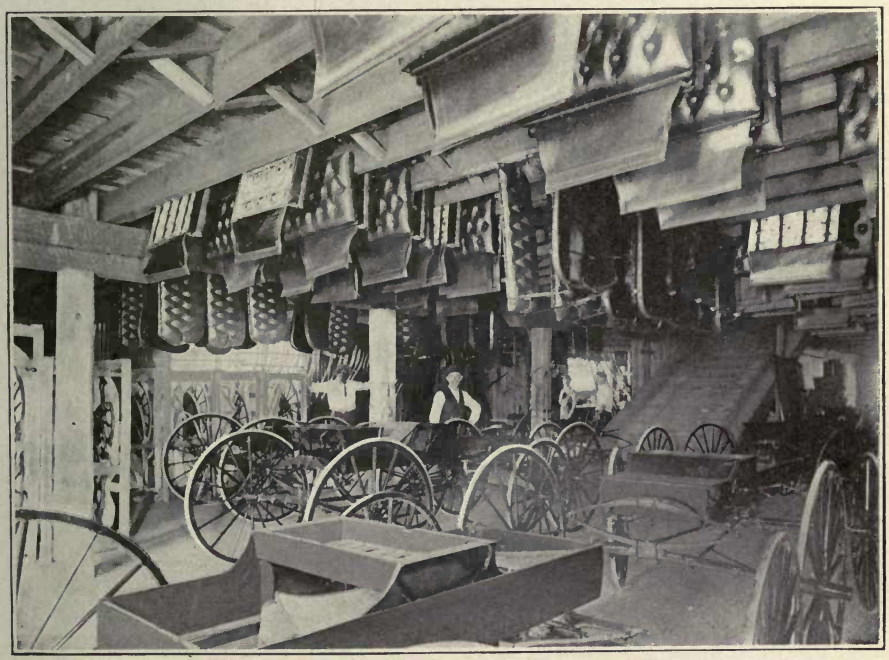
Kind of Wood.	Grown in North Carolina.		Grown Outside of North Carolina.		Total Quantity of Raw Material Used Annually.			Percentage of Quantity Required by All Industries in State.
	Quantity, Feet b. m.	Average Cost per M bd. ft. Delivered at Factory.	Quantity, Feet b. m.	Average Cost per M bd. ft. Delivered at Factory.	Quantity, Feet b. m.	Average Cost per M bd. ft. Delivered at Factory.	Total Cost Delivered at Factory.	
Red, white, Spanish and chestnut oak	21,947,000	$ 17.13		$	21,947,000	$ 17.13	$ 375,952.11	15.13
North Carolina pine	4,470,000	12.96	50,000	30.00	4,520,000	13.14	59,431.20	1.00
Yellow poplar	1,495,000	18.57	2,600,000	22.55	4,095,000	20.96	85,820.15	11.60
Chestnut	1,000,000	17.20			1,000,000	17.20	17,200.00	12.90
Ash	100,000	17.00			100,000	17.00	1,700.00	7.06
Basswood	100,000	16.00			100,000	16.00	1,600.00	38.00
Red gum	51,000	20.00			51,000	20.00	1,020.00	.21
Maple	50,000	20.00			50,000	20.00	1,000.00	1.20
Birch	2,000	24.00			2,000	24.00	48.00	.40
Cherry	2,000	24.00			2,000	24.00	48.00	6.90
Mahogany			1,000	120.00	1,000	120.00	120.00	1.60
Totals	29,217,000	16.57	2,651,000	22.72	31,868,000	17.06	543,939.46	

VEHICLES.

Vehicles of all kinds are included in this industry, from the finest finished carriage and phæton down to the dump-cart and the logging truck. Table 13 does not represent the full amount of material consumed in the manufacture of vehicles in North Carolina, though it comprises a very large percentage. In every village, town, and city of the State there are wagon makers who turn out a few vehicles in the course of the year, but whose chief work is repairing. A large quantity of wood is used. An effort was made to include all, but lack of information as to the exact locations of many, and the indifference of others to the work, and their ignoring requests for information, made the collecting of this data more difficult than for any other industry. The convenience of being near the source of supply has attracted to North Carolina large manufacturers of vehicles. See Plate V, A and B.

A number of the manufacturers of vehicles in this State merely assemble the component parts and put on the finishing touches. Information from this class, as stated before, was not solicited. The data furnished by the manufacturers of hubs, rims, spokes, bodies, axles, etc., together with the amount of raw material used by those industries which make the vehicle in all its parts, are shown in Table 13. Eight woods are listed, and hickory leads the list in quantity, being 60 per cent of all the hickory reported in the State. Forty-four per cent of the vehicle wood grew outside the State, no other industry reporting so large a percentage of its material. Tough, strong woods are essential, and this accounts for the fact that average prices paid by vehicle makers for their woods were above those in any other industry. High grades of lumber were demanded. In this connection it is worthy of note that 88 per cent of the manufacturers listed under this industry purchased their material in established grades, which was above the percentage of any other industry.

A. INTERIOR VIEW OF WHEEL FACTORY OF HIGH POINT BUGGY COMPANY, HIGH POINT, N. C.



B. INTERIOR VIEW OF PACKING DEPARTMENT OF HIGH POINT BUGGY COMPANY, HIGH POINT, N. C.

TABLE 13.—TRUCKS, VEHICLES, AND WAGONS.

Kind of Wood.	Grown in North Carolina.		Grown Outside of North Carolina.		Total Quantity of Raw Material Used Annually.			Percentage of Quantity Required by All Industries in State.
	Quantity, Feet b. m.	Average Cost per M bd. ft. Delivered at Factory.	Quantity, Feet b. m.	Average Cost per M bd. ft. Delivered at Factory.	Quantity, Feet b. m.	Average Cost per M bd. ft. Delivered at Factory.	Total Cost Delivered at Factory.	
Hickory	1,440,000	$ 34.43	5,145,000	$ 28.93	6,585,000	$ 29.08	$ 191,532.10	60.00
White oak	3,260,000	26.40	1,025,000	22.63	4,285,000	25.50	109,314.00	3.00
Yellow poplar	1,404,000	29.80	655,000	31.29	2,059,000	30.32	62,336.69	5.80
North Carolina pine	1,431,000	18.12	25,000	20.00	1,456,000	18.29	26,429.72	.40
White ash	884,000	27.88	10,000	30.00	894,000	27.88	25,045.92	63.10
Red gum	250,000	18.30			250,000	18.30	4,575.00	1.03
Elm	87,000	20.00			87,000	20.00	1,740.00	44.10
Hard maple	20,000	15.00			20,000	15.00	300.00	.50
Totals	8,776,000	25.96	6,860,000	28.19	15,636,000	26.30	421,273.43	

FRUIT AND VEGETABLE PACKAGES.

The products of this industry comprise baskets and packages in which fruit and vegetables are shipped and marketed. The growing custom of selling provisions to the consumer in individual packages has in recent years increased the importance of this industry in North Carolina. The commodities are grape baskets, fruit baskets, berry cups, vegetable cups, hoppers, barrels (veneer), and vegetable crates, and the business of making them is confined to the Coastal region, where truck farming and fruit growing is a thriving and rapidly-growing industry.

The raw material is delivered to the basket maker in log form, and this accounts for the low price paid as compared with the other industries. The price was $7.65 per M feet log scale, and was the lowest reported by any of the twenty-one industries. It was 66 cents lower than the price paid by excelsior makers, who buy their wood in the forms of billets and poles.

Six kinds of wood were reported, as shown in Table 14. The first process of manufacture consists in converting the logs into sheets of veneer, and a further process finishes the articles. The cores which remain after the veneer is cut from the logs are largely sawed into thin lumber and utilized for the covers and bottoms of barrels, hoppers, baskets, etc., and for making light vegetable crates.

In the quantity of wood consumed this class of manufacturers stands seventh on the list of North Carolina's wood-using industries, while in the amount of money paid for raw material it ranks ninth on the list.

All of the wood used is grown in the State, and in board measure amounts to 8,862,000 feet. Red and tupelo gum, the former being more extensively employed, head the list for quantity. More red gum is cut into veneers than any other wood, and a large percentage of it goes into baskets, crates, and packages. North Carolina pine is second on the list in the quantity used. As in the case of boxes, large sawmills often manufacture fruit and vegetable packages as a side line.

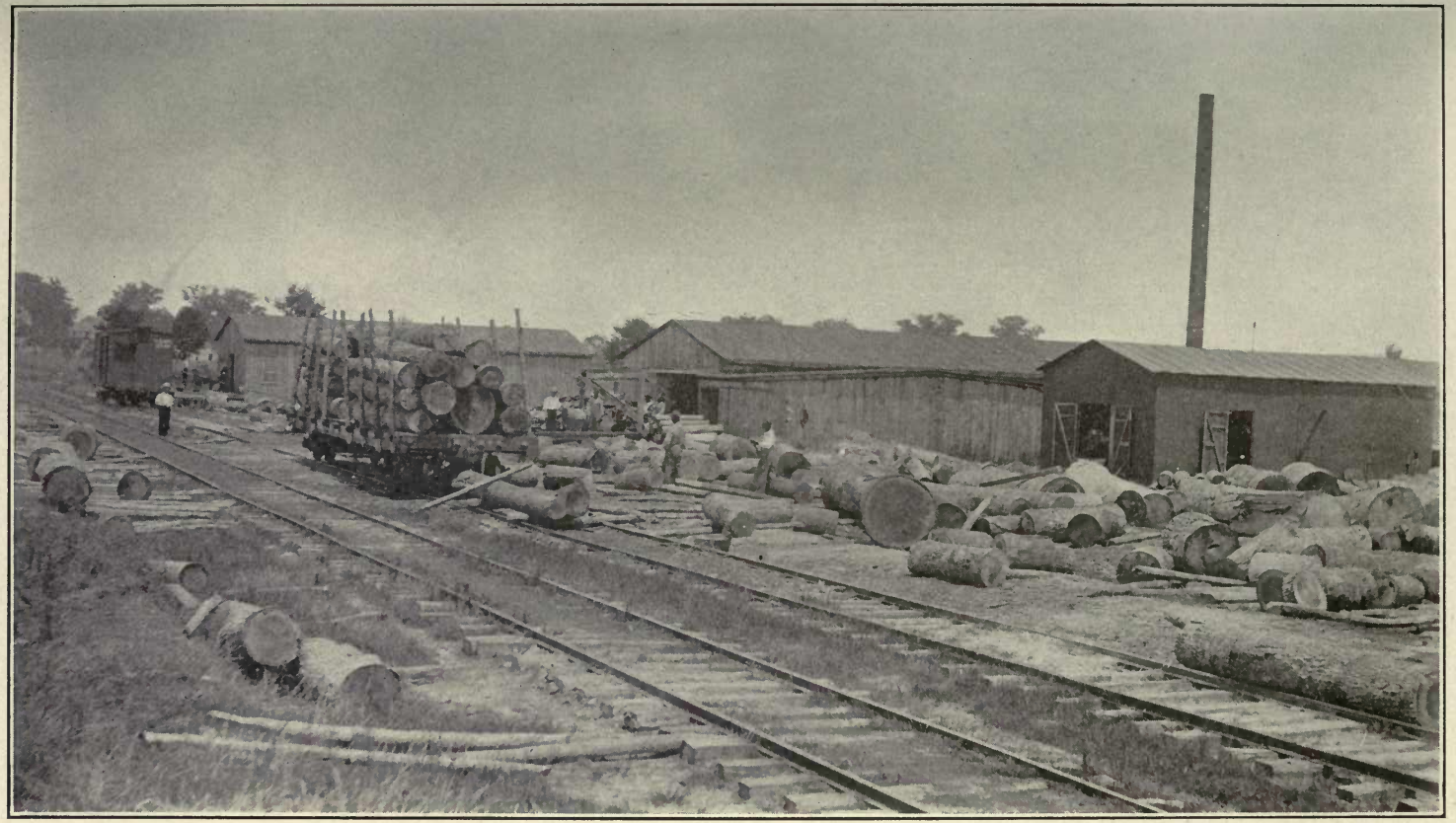


PLATE VI. MILL AND YARD OF THE WILKES VENEER COMPANY, EDENTON, N. C.

TABLE 14.—FRUIT AND VEGETABLE PACKAGES.

Kind of Wood.	Grown in North Carolina.		Grown Outside of North Carolina.		Total Quantity of Raw Material Used Annually.			Percentage of Quantity Required by All Industries in State.
	Quantity, Feet b. m.	Average Cost per M bd. ft. Delivered at Factory.	Quantity, Feet b. m.	Average Cost per M bd. ft. Delivered at Factory.	Quantity, Feet b. m.	Average Cost per M bd. ft. Delivered at Factory.	Total Cost Delivered at Factory.	
Red and tupelo gum	6,180,000	$ 7.67		$	6,180,000	$ 7.67	$ 47,400.60	25.36
North Carolina pine	2,020,000	7.26			2,020,000	7.26	14,665.20	.50
Yellow poplar	362,000	9.64			362,000	9.64	3,489.68	1.03
Maple	150,000	8.00			150,000	8.00	1,200.00	4.00
Elm	100,000	7.00			100,000	7.00	700.00	50.80
Sycamore	50,000	7.00			50,000	7.00	350.00	13.60
Totals	8,862,000	7.65			8,862,000	7.65	67,805.48	

INSULATOR PINS AND BRACKETS.

Makers of insulator pins and brackets bought all their wood in North Carolina. This industry stands ninth on the list for quantity of material consumed. Only three woods are reported, white and chestnut oak, and yellow locust. The 3,000,000 feet of oak utilized is 2 per cent of the total amount of this kind of wood used in this State. The average price per M feet paid is less than that reported for this wood by any other industry. This is because raw material for making insulator pins is bought as logs and bolts. The yellow locust recorded in Table 15 constitutes the whole of this wood reported in the State, and the amount consumed was 2,600,000 feet, the price paid being $14 per thousand feet.

TABLE 15.—INSULATOR PINS AND BRACKETS.

Kind of Wood.	Raw Material Used Annually, and Grown in North Carolina.			Percentage of Quantity Required by All Industries in State.
	Quantity, Feet b. m.	Average Cost per M bd. ft. Delivered at Factory.	Total Cost Delivered at Factory.	
White and chestnut oak	3,000,000	$ 5.00	$ 15,000.00	2.06
Yellow locust	2,600,000	14.00	36,400.00	100.00
Totals	5,600,000	9.18	51,400.00	

COFFINS, CASKETS, AND CASKET CASES.

Notwithstanding that many of the coffins and caskets sold in North Carolina are manufactured elsewhere, this industry stands tenth on the list in quantity of lumber used, the amount being 5,000,000 feet annually, at an average cost of $17.09 per M. This is one of only eight industries considered in this report which pays more than an average of $17 per M feet for raw material. North Carolina pine is highest in quantity used, as is shown in Table 16, which records the use of seven other woods. More than 10 per cent of the pine is grown outside of the State, and is reported shipped from South Carolina. This industry paid 73 cents more for yellow pine than was paid by the makers of sash, doors, and blinds, and $1.26 more than the average paid by the manufacturers of floor, ceiling, and siding. North Carolina pine is used in making all the products of this industry, while chestnut, following next in importance, is utilized only for making caskets. The total chestnut used was 1,300,000 feet, which was 17 per cent of all the chestnut manufactured in North Carolina. The sound wormy is the grade most commonly desired. The average price of this delivered at the fac-

TABLE 16.—COFFINS, CASKETS, AND CASKET CASES.

Kind of Wood.	Grown in North Carolina.		Grown Outside of North Carolina.		Total Quantity of Raw Material Used Annually.			Percentage of Quantity Required by All Industries in State.
	Quantity, Feet b. m.	Average Cost per M bd. ft. Delivered at Factory.	Quantity, Feet b. m.	Average Cost per M bd. ft. Delivered at Factory.	Quantity, Feet b. m.	Average Cost per M bd. ft. Delivered at Factory.	Total Cost Delivered at Factory.	
North Carolina pine	1,899,000	$ 13.48	200,000	$ 15.00	2,099,000	$ 13.63	$ 28,610.02	.50
Chestnut	1,300,000	18.00			1,300,000	18.00	23,400.00	16.80
White pine	595,000	22.02			595,000	22.02	13,143.55	4.50
Yellow poplar	455,000	18.53	100,000	24.00	555,000	19.51	10,831.15	1.60
Red cedar	125,000	25.00			125,000	25.00	3,125.00	86.20
Black walnut	50,000	31.60			50,000	31.60	1,580.00	8.50
Cypress			40,000	20.00	40,000	20.00	800.00	1.40
White oak	11,000	10.00			11,000	10.00	110.00	.008
Totals	4,435,000	17.03	340,000	18.00	4,775,000	17.09	81,599.72	

tory is $18 per M feet. All the chestnut used was State grown. Higher grades of white pine are demanded by this industry than by any other in the State, and its average price was $22.02, while the price paid by the sash, door, and blind manufacturers was only $17.95. Of the poplar consumed by the coffin and casket makers, 20 per cent is grown outside of the State, and comes from Tennessee. Red cedar is used for manufacturing both coffins and caskets, while black walnut is used only for coffins. The prices paid for these two species are higher than any of the others in this industry. Black walnut averaged $31.60 per M feet, and red cedar $25.

HANDLES.

The kinds of handles manufactured by this industry in North Carolina are, axe, pick, maul, sledge, hammer, tool, and machinery. Hickory alone is used in the making of these handles, being the only available wood possessing the necessary qualities of flexibility and strength. As shown in Table 17, the handle makers consume 3,595,000 feet annually. This is purchased in the form of bolts and billets, and represents one-third of the hickory used in manufacture in the State. All of this material was grown in North Carolina, and its average price was $17.30 per thousand feet.

TABLE 17.—AXE, TOOL, AND MACHINERY HANDLES.

Kind of Wood.	Raw Material Used Annually, and Grown in North Carolina.			Percentage of Quantity Required by All Industries in State.
	Quantity, Feet b. m.	Average Cost per M bd. ft. Delivered at Factory.	Total Cost Delivered at Factory.	
Hickory	3,595,000	$ 17.30	$ 62,193.50	32.60

SHUTTLES, SPOOLS, BOBBINS, ETC.

Statistics of this industry include shuttles, spools, bobbins, skewers, and picker-sticks. These articles are not all made in the same factories, but they have been grouped together for convenience of compilation. The raw material was purchased in the form of logs, bolts, billets, and sawed squares. The average prices given in the table are for so many forms and sizes that they are of little value for comparison and study. Seven woods were reported, the list being headed by maple, which totaled 2,160,000 feet. Dogwood and persimmon were reported for this industry alone, and are used almost exclusively in making shuttles. Dogwood stands second on the list in quantity. Two per cent of the hickory used in the State goes into the products of this industry, principally

into skewers and picker-sticks. The birch is manufactured into bobbins, spools, skewers, and picker-sticks. Thirty-one per cent of all the birch manufactured in the State, and 38 per cent of the beech go into these articles.

TABLE 18.—SHUTTLES, BOBBINS, SPOOLS, AND SKEWERS.

Kind of Wood.	Raw Material Used Annually, and Grown in North Carolina.			Percentage of Quantity Required by All Industries in State.
	Quantity, Feet b. m.	Average Cost per M bd. ft. Delivered at Factory.	Total Cost Delivered at Factory.	
Maple	2,160,000	$ 15.14	$ 32,702.40	53.00
Dogwood	600,000	18.75	11,250.00	100.00
Hickory	240,000	28.13	6,751.20	2.20
Birch	160,000	16.25	2,600.00	31.20
Persimmon	150,000	20.00	3,000.00	100.00
Yellow poplar	110,000	10.47	1,151.70	.31
Beech	60,000	10.00	600.00	38.70
Totals	3,480,000	16.63	58,055.30	

FARMING IMPLEMENTS.

The manufacturers of farming implements report using 3,391,000 feet of lumber annually, which is one-half of 1 per cent of the total consumed by all the manufacturers in the State in 1909. Only four woods are reported—gum, oak, and white and yellow pine. Seventy-three per cent was red and tupelo gum, which was 10 per cent of all the gum manufactured in the State. Oak is next in quantity used by these manufacturers, red oak, white oak, and post oak being reported. The average cost per M feet was $20.18, which was higher than the price paid for oak by the furniture, chair, and table manufacturers. North Carolina pine stands third on the list, being less than 10 per cent of the wood used in this industry. The average price for white pine was $54 per M feet, which was the highest price reported in the State for American woods. Table 19 below presents the available statistics:

TABLE 19.—FARMING IMPLEMENTS.

Kind of Wood.	Raw Material Used Annually, and Grown in North Carolina.			Percentage of Quantity Required by All Industries in State.
	Quantity, Feet b. m.	Average Cost per M bd. ft. Delivered at Factory.	Total Cost Delivered at Factory.	
Red and tupelo gum	2,500,000	$ 10.00	$ 25,000.00	10.26
Red, white and water oak	546,000	20.18	11,018.38	.37
North Carolina pine	335,000	11.87	3,976.45	.08
White pine	10,000	54.00	540.00	.08
Totals	3,391,000	11.95	40,534.83	

KITCHEN SAFES.

This is the third subdivision of furniture classified in this study as a distinct industry. It includes cupboards, safes, and cabinets. A cabinet is a kind of safe whose space is ingeniously divided up into many compartments, providing a convenient place for provisions usually kept on hand in the kitchen, such as flour, sugar, meal, salt, coffee, etc. This class of furniture is more cheaply manufactured than articles for living-rooms and parlors, and it does not require the skill of highly trained workmen, nor the best grades of lumber for its manufacture. Oak is the principal wood used, and averages in price only $11.39 per M, while the oak from which chairs and tables are made was reported at a cost of $18.16 and $17.13 per M, respectively. The quantity of yellow poplar used was 1,575,000 feet, that being only 75,000 feet less than the quantity of oak used. It was all grown in North Carolina, making this the only industry considered in this study in which all of the poplar used was grown in the State. The average price for this kind of wood was $18.67 per M, which was $1.47 higher than the price paid by the furniture makers. The oak is mostly used for the outside work of safes, cabinets, and cupboards, while poplar is utilized for inside work, such as shelvings, partitions, etc., and for both inside and outside work of the cabinets. The chestnut was of the sound wormy grade, a limited quantity only being used in 1909. The cost is about the average reported by other industries for this kind of wood. It is all grown in North Carolina.

TABLE 20.—KITCHEN SAFES, CABINETS, AND CUPBOARDS.

Kind of Wood.	Raw Material Used Annually, and Grown in North Carolina.			Percentage of Quantity Required by All Industries in State.
	Quantity, Feet b. m.	Average Cost per M bd. ft. Delivered at Factory.	Total Cost Delivered at Factory.	
Red, white, post and Spanish oak	1,650,000	$ 11.39	$ 18,793.50	1.13
Yellow poplar	1,575,000	18.67	29,405.25	4.50
Chestnut	100,000	15.00	1,500.00	1.30
Totals	3,325,000	14.95	49,698.75	

CROSS-ARMS.

The making of cross-arms for telegraph and telephone poles is a very simple operation. It consists merely in shaping into form, by the use of machinery, the raw material purchased in the form of squares of the proper size, and by boring holes for insulator pins. North Carolina pine is the only wood reported for these products. The average price

paid was $14.66 per M, or $2.55 above the average cost of this wood used in the State by all manufacturers. The total was 2,800,000 feet, and was less than three-fourths of 1 per cent of all the yellow pine manufactured by the wood-using industries of North Carolina.

TABLE 21.—CROSS-ARMS (TELEPHONE AND TELEGRAPH).

Kind of Wood.	Raw Material Used Annually, and Grown in North Carolina.			Percentage of Quantity Required by All Industries in State.
	Quantity, Feet b. m.	Average Cost per M bd. ft. Delivered at Factory.	Total Cost Delivered at Factory.	
North Carolina pine	2,816,000	$ 14.66	$ 41,282.54	.7

PIPES, MINE ROLLERS, AND PULLEYS.

Table 22 shows a practical use for black gum, which until recently was considered of little value for manufacturing purposes. It is cheaper than maple and has largely displaced it for the manufacture of mine rollers, and is used with red gum in making pulleys. The annual quantity of black gum used in North Carolina for making these products is 2,500,000 feet, reported at an average price of $8.36 per M. This is the only class of manufacturers in the State reporting black gum as a raw material.

Pipes have been classified under this industry for convenience of tabulation, but have no relation to mine rollers and pulleys. These are smoking pipes and are articles made of the root of the kalmia, which is better known as mountain laurel. The laurel comes to the factory in the form of roots and burls, and costs about 25 cents per hundred pounds at the factory, which, reduced to the basis of board measure, makes the price paid approximately $10 per M feet, board measure.

TABLE 22.—PIPES, PULLEYS, AND MINE ROLLERS.

Kind of Wood.	Raw Material Used Annually, and Grown in North Carolina.			Percentage of Quantity Required by All Industries in State.
	Quantity, Feet b. m.	Average Cost per M bd. ft. Delivered at Factory.	Total Cost Delivered at Factory.	
Black gum	2,500,000	$ 8.36	$ 20,900.00	100.00
Kalmia	22,000	10.00	220.00	100.00
Red gum	10,000	12.00	120.00	.04
Totals	2,532,000	8.39	21,240.00	

STORE AND OFFICE FIXTURES, MANTELS, ETC.

There is a class of work for inside trim for buildings which is of a higher grade than described under sash, doors, blinds, etc., and consists chiefly of carved moldings, mantels, grills, and cabinets. Twenty-two woods are used, as shown in Table 23, and it is the largest list of woods reported by any industry in North Carolina. Highest grades of lumber are used, and it is due to this fact that the manufacturers of fixtures pay more for their raw material than is paid by any other of the woodworking industries. The cheapest wood reported was hemlock at $12 per M feet, while Circassian walnut was the most expensive at $200.

Furniture makers paid $26.71 per M more for mahogany than was paid by this industry. Twenty per cent of the lumber used was grown outside of the State. The average price of the home-grown wood was $5.42 less per thousand feet than of that shipped in from other States. Hemlock, buckeye, butternut, and Circassian walnut are not reported used in any other industry.

TABLE 23.—STORE AND OFFICE FIXTURES, MANTELS, AND CABINETS.

Kind of Wood.	Grown in North Carolina.		Grown Outside of North Carolina.		Total Quantity of Raw Material Used Annually.			Percentage of Quantity Required by All Industries in State.
	Quantity, Feet b. m.	Average Cost per M bd. ft. Delivered at Factory.	Quantity, Feet b. m.	Average Cost per M bd. ft. Delivered at Factory.	Quantity, Feet b. m.	Average Cost per M bd. ft. Delivered at Factory.	Total Cost Delivered at Factory.	
Red and white oak	812,000	$ 40.03	60,000	$ 60.00	872,000	$ 41.40	$ 36,104.36	.61
North Carolina pine	2,000	20.00	300,000	12.50	302,000	12.54	3,790.00	.07
Red and tupelo gum	260,000	29.42			260,000	29.42	7,649.20	1.07
Yellow poplar	217,000	32.41	15,000	20.00	232,000	32.41	7,300.56	.66
White pine	140,000	31.96			140,000	31.96	4,474.40	1.07
Chestnut	115,000	19.30			115,000	19.30	2,219.50	1.50
Yellow birch	80,000	42.18			80,000	42.18	3,374.40	15.60
Maple	50,000	31.50			50,000	31.50	1,575.00	1.20
Black walnut	31,000	66.13	10,000	70.00	41,000	66.43	2,750.25	6.90
Basswood	40,000	40.00			40,000	40.00	1,600.00	15.00
Ash	30,000	25.00			30,000	25.00	750.00	2.12
Cherry	27,000	50.00			27,000	50.00	1,350.00	93.10
Hemlock	25,000	12.00			25,000	12.00	300.00	100.00
Mahogany			24,000	132.50	24,000	132.50	3,180.00	37.30
Beech	20,000	40.00			20,000	40.00	800.00	12.90
Red cedar	20,000	40.00			20,000	40.00	800.00	13.80
Hickory	20,000	40.00			20,000	40.00	800.00	.18
Butternut	20,000	40.00			20,000	40.00	800.00	100.00
Cypress			15,000	30.00	15,000	30.00	450.00	.54
Sycamore			15,000	20.00	15,000	20.00	300.00	4.07
Buckeye	10,000	40.00			10,000	40.00	400.00	100.00
Circassian walnut			3,000	200.00	3,000	200.00	600.00	100.00
All others*			3,000	80.00	3,000	80.00	240.00	100.00
Totals	1,919.000	35.53	445,000	30.11	2,364,000	34.52	81,607.67	

*Includes only imported woods not mentioned.

MUSICAL INSTRUMENTS.

Seven woods are listed in the manufacture of musical instruments, as shown in Table 24. High-grade oak and black walnut, in equal quantities, head this list. Eighty-four per cent of the black walnut manufactured in North Carolina goes into musical instruments, and 54 per cent of the sycamore is so used. White pine is reported at the low price of $12 per M, its chief use being for crating material and organ boxes. Next to vehicle manufacture, musical instruments draw the largest comparative quantity of their wood from forests outside of North Carolina. The products are not varied, reed organs, cabinet organs, and pipe organs alone being manufactured.

TABLE 24.—MUSICAL INSTRUMENTS.

Kind of Wood.	Grown in North Carolina.		Grown Outside of North Carolina.		Total Quantity of Raw Material Used Annually.			Percentage of Quantity Required by All Industries in State.
	Quantity, Feet b. m.	Average Cost per M bd. ft. Delivered at Factory.	Quantity, Feet b. m.	Average Cost per M bd. ft. Delivered at Factory.	Quantity, Feet b. m.	Average Cost per M bd. ft. Delivered at Factory.	Total Cost Delivered at Factory.	
Red and white oak	500,000	$ 22.50		$	500,000	$ 22.50	$ 11,250.00	.34
Black walnut	100,000	40.00	400,000	40.00	500,000	40.00	20,000.00	84.60
Yellow poplar	300,000	20.00			300,000	20.00	6,000.00	.85
Sycamore	200,000	10.00			200,000	10.00	2,000.00	54.20
Chestnut			200,000	20.00	200,000	20.00	4,000.00	2.60
White pine	100,000	12.00			100,000	12.00	1,200.00	.76
Totals	1,200,000	20.38	600,000	33.33	1,800,000	24.70	44,450.00	

PLANKING FOR BOATS.

White cedar is more in demand by the builders of boats and launches, to be used as planking or siding, than any other wood required for that purpose. In North Carolina the stand of white cedar, from which this commodity can be manufactured, is being rapidly exhausted. Accordingly, this industry has become entirely a side line, the white-cedar shingle manufacturers producing all the boat planking made in North Carolina in 1909. The average price of cedar as given in Table 25 was $14.38. This being reported in terms of "log scale" indicates the high price this commodity brings on the market in a manufactured state. Shingles are not considered in this report, owing to their being included with cooperage stock, cross-ties, etc., in the annual report issued by the Bureau of Census in coöperation with the Forest Service. Exclusive of the material used for making shingles, therefore, 76 per cent of the white cedar going into manufactures in this State is utilized for boat siding.

TABLE 25.—BOAT PLANKING.

Kind of Wood.	Raw Material Used Annually, and Grown in North Carolina.			Percentage of Quantity Required by All Industries in State.
	Quantity, Feet b. m.	Average Cost per M bd. ft. Delivered at Factory.	Total Cost Delivered at Factory.	
White cedar	800,000	$ 14.38	$ 11,504.00	76.2

EXCELSIOR.

Only three woods are reported in Table 26 for making excelsior in North Carolina—yellow poplar, white pine, and yellow pine, named in the order of quantity used. The total amount manufactured was 800,000 feet, purchased at an outlay of $6,352. The average price paid for this raw material was $8.30 per M feet, delivered at the factory in the form of billets and poles. The following table presents the available statistics for 1909:

TABLE 26.—EXCELSIOR.

Kind of Wood.	Raw Material Used Annually, and Grown in North Carolina.			Percentage of Quantity Required by All Industries in State.
	Quantity, Feet b. m.	Average Cost per M bd. ft. Delivered at Factory.	Total Cost Delivered at Factory.	
White pine	300,000	$ 6.34	$ 1,902.00	2.29
Yellow poplar	300,000	10.00	3,000.00	.85
Yellow pine	200,000	7.25	1,450.00	.05
Totals	800,000	8.31	6,352.00	

WOODENWARE.

Candy, well, and water buckets, pails, tubs of various kinds, chop bowls, firkins, churns, ironing boards, bread boards, washboards, and other articles pertaining to household use are the principal products of the woodenware manufacturers of North Carolina. Six kinds of woods were reported at an average price of $17 per M. A total of 775,000 feet were manufactured, all grown in North Carolina. This industry uses less raw material than any other considered in this study. White cedar, which in North Carolina is commonly but improperly called juniper, headed the list in amount used, and it constituted 24 per cent of the wood demanded by this industry. The white poplar and white cypress noted in the table are known to the local trade by these names, but are in fact only the sapwood of yellow poplar and red cypress. They were recorded in this individual table by these local names in order to indicate to any one desiring to sell raw material for this class of manufactures the kind of wood desired. White cypress is used for confectionery buckets and other packages. It is especially demanded for this purpose, as experience has shown that this wood imparts no taste to the contents of the package. White ash is used for butter tubs and firkins, and 7 per cent of this wood manufactured in the State goes into these products.

TABLE 27.—WOODENWARE.

Kind of Wood.	Raw Material Used Annually, and Grown in North Carolina.			Percentage of Quantity Required by All Industries in State.
	Quantity, Feet b. m.	Average Cost per M bd. ft. Delivered at Factory.	Total Cost Delivered at Factory.	
		$		
White cedar	250,000	20.00	$ 5,000.00	23.80
Yellow poplar	100,000	15.00	1,500.00	.28
(White) poplar	100,000	12.00	1,200.00	100.00
White ash	100,000	20.00	2,000.00	7.06
(White) cypress	100,000	15.00	1,500.00	100.00
White oak	100,000	15.00	1,500.00	.07
White pine	25,000	18.00	450.00	.19
Totals	775,000	17.00	13,150.00	

APPENDIX I.

USES OF THE DIFFERENT KINDS OF WOOD.

Some of the various uses for the many kinds of wood entering into manufacture in North Carolina are given in the list which follows.

ASH.

Axles,
Buckets,
Buggy bodies,
Felloes (Wagon),
Furniture,
Gears (Running),
Interior trimming,
Measures,
Tables (Dining),
Tables (Extension),
Tops (Wagon),
Wagons,
Woodenware.

BASSWOOD.

Cabinet work,
Fixtures (Office),
Fixtures (Store),
Furniture,
Interior trimming,
Tables,
Tables (Extension).

BEECH.

Bobbins,
Cabinet work,
Fixtures (Office),
Fixtures (Store),
Furniture,
Interior trimming,
Mantels,
Shuttles,
Skewers,
Spools.

BIRCH.

Bobbins,
Chairs,
Furniture,
Interior trimming,
Moldings (Fancy),
Rockers,
Showcases,
Skewers,
Stands,
Tables (Extension).

BLACK GUM.

Back bands,
Baskets,
Baskets (Fruit),
Baskets (Vegetable),
Cases (Berry),
Cases (Fruit),
Cases (Vegetable),
Crates (Vegetable),
Cases (Berry),
Cups (Quart),
Hoppers,
Implements (Agricultural),
Rollers (Log wagon),
Rollers (Mine),
Slack cooperage,
Trays.

BLACK AND YELLOW LOCUST.

Brackets (Pole),
Insulator pins.

BLACK WALNUT.

Cabinet work,
Coffins,
Fixtures (Bar),
Fixtures (Office),
Fixtures (Store),
Organs (Pipe),
Organs (Reed),
Showcases.

BOX ELDER.

Interior trimming.

BUCKEYE.

Cabinet work,
Fixtures (Office).

BUTTERNUT.

Cabinet work,
Fixtures (Office),
Fixtures (Store),
Furniture (Inside of).

CIRCASSIAN WALNUT.

Cabinet work,
Fixtures (Office),
Fixtures (Store),
Interior trimming,
Moldings (Fancy).

CHERRY.

Cabinet work,
Fixtures (Office),

Fixtures (Store),
Furniture,
Interior trimming,
Mantels,
Moldings (Fancy),
Panels,
Pedestals,
Showcases,
Stands,
Tables (Library),
Tables (Parlor).

CHESTNUT.

Blocks (Base),
Blocks (Corner),
Boards (Wash),
Cabinet work,
Caskets,
Coffins,
Cradles,
Exterior trimming,
Fixtures (Office),
Fixtures (Store),
Flooring,
Furniture,
Furniture (Mission),
Interior trimming,
Mantels,
Moldings (Stock),
Organs (Pipe),
Organs (Reed),
Panels,
Partition,
Pedestals,
Showcases,
Stair work,
Stands,
Tables,
Tables (Dining),
Tables (Library),
Tables (Sewing).

COTTONWOOD.

Interior trimming.

CUCUMBER.

Interior trimming.

DOGWOOD.

Bobbins.

ELM.

Baskets,
Baskets (Grape),
Baskets (Fruit),
Chairs,
Crates,
Hoppers,
Rockers,
Tops (Buggy),
Trays.

HARD MAPLE.

Bobbins,
Cabinet work,
Chairs,
Chairs (Reclining),
Desks (School),
Flooring,
Frames (Wagon bed),
Frames (Buggy box),
Furniture,
Moldings (Stock),
Panels,
Pedestals,
Piano stools,
Rockers,
Skewers,
Spools,
Stands,
Sticks (Picker),
Tables.

HEMLOCK.

Fixtures (Office),
Fixtures (Store),
Interior trimming.

HICKORY.

Axles,
Bobbins,
Buggies,
Carriages,
Carts,
Casing (Axle),
Chairs,
Fixtures (Office),
Fixtures (Store),
Handles (Axe),
Handles (Machinery),
Handles (Tool),
Picker sticks,
Rims,
Rockers,
Shuttles,
Singletrees,
Skewers,
Spokes,
Shafts,
Sulkies,
Trucks,
Wagons,
Wheels.

KALMIA.

Holders (Cigar),
Pipes (Tobacco).

MAHOGANY.

Cabinets (Music),
Cabinet work,
Fixtures (Office),
Fixtures (Store),
Furniture,

Interior trimming,
Mantels,
Moldings (Fancy),
Panels,
Pedestals,
Stands,
Showcases,
Tables (Extension),
Tables (Library),
Tables (Parlor),
Tables (Serving),
Tables (Sewing).

NORTH CAROLINA PINE.

Balusters,
Baskets,
Blinds,
Boxes,
Boxes (Rough),
Brackets,
Buggy bodies,
Cabinet works,
Car siding,
Carriage bodies,
Casing,
Caskets,
Ceiling,
Coffins,
Corner strips,
Cornice work,
Crates (Vegetable),
Crates (Fruit),
Cross-arms,
Cultivators,
Diggers,
Door frames,
Doors,
Doors (Front),
Excelsior,
Factory flooring,
Fixtures (Store),
Fixtures (Office),
Flooring,
Furniture,
Grill work,
Hand rails,
Harrows,
Hoppers,
Interior trimming,
Mantels,
Newel posts,
Organs,
Panels,
Partition,
Planters,
Plows,
Poles,
Porch columns,
Sashes,
Seeders,
Shooks (Box),
Showcases,
Siding,
Slack cooperage,
Stair work,
Stock novelties,
Store fronts,
Spindles,
Window frames.

PERSIMMON.

Bobbins,
Shuttles,
Skewers.

POST OAK.

Brackets (Telephone pole),
Chairs,
Cupboards (Kitchen),
Doors,
Furniture,
Implements (Farming),
Interior trimming,
Safes (Kitchen),
Showcases,
Slack cooperage,
Tables,
Tables (Kitchen).

RED CEDAR.

Boxes (Clothes),
Casket shells,
Caskets,
Furniture,
Interior trimming,
Shingles.

RED CYPRESS.

Base blocks,
Base boards,
Casing,
Doors,
Exterior trimming,
Flooring,
Interior trimming,
Molding (Stock),
Partition,
Sash,
Shingles,
Washboards.

RED OAK.

Agricultural implements,
Base blocks,
Bedroom suits,
Brackets,
Brackets (Telegraph),
Brackets (Telephone),
Buffets,
Bureaus,
Cabinet work,
Cabinets (Kitchen),
Cabinets (Wall),
Cabinets (Parlor),

Cabinets (China),
Chairs,
Chairs (Reclining),
Chiffoniers,
Cradles,
Cultivators,
Cupboards,
Davenports,
Desks,
Doors,
Doors (Front),
Dressers,
Fixtures (Office),
Fixtures (Store),
Flooring,
Furniture,
Harrows,
Hall racks,
Interior trimming,
Lamp stands,
Lounges,
Mantels,
Moldings (Stock),
Organs (Pipe),
Organs (Reed),
Partition,
Pedestals,
Piano stools,
Piano benches,
Planters,
Plows,
Rockers,
Safes (Kitchen),
Secretaries,
Seeders,
Showcases,
Sideboards,
Slack cooperage,
Sofas,
Stands,
Stair work,
Washboards.

RED AND TUPELO GUM.

Base boards,
Baskets (Grape),
Baskets (Fruit),
Baskets (Vegetable),
Baskets (Split),
Boxes (Berry),
Boxes (Plug tobacco),
Buggy bodies,
Cabinet work,
Cases (Berry),
Cases (Smoking tobacco),
Chairs,
Crates (Fruit),
Crates (Truck),
Cups (Quart),
Fixtures (Office),
Fixtures (Store),
Furniture,
Hoppers,
Interior trimming,
Mantels,
Mine rollers,
Moldings (Fancy),
Moldings (Stock),
Panels,
Pedestals,
Pulleys,
Rockers,
Stands,
Tables,
Tables (Card),
Tables (Parlor),
Tables (Sewing),
Trays.

SOFT MAPLE.

Baskets,
Crates (Fruit),
Crates (Truck),
Furniture,
Hoppers.

SPANISH OAK.

Blocks (Base),
Blocks (Corner),
Boards (Base),
Brackets (Telegraph pole),
Cabinets (Kitchen),
Chairs,
Cupboards,
Doors,
Flooring,
Furniture,
Furniture (Mission),
Implements (Agricultural),
Interior trimming,
Moldings (Stock),
Partition,
Piano benches,
Piano stools,
Rockers,
Safes (Kitchen),
Showcases.
Slack cooperage,
Sofas,
Stands,
Tables (Card),
Tables (Extension),
Tables (Kitchen),
Tables (Library),
Tables (Parlor),
Tables (Serving),
Tables (Typewriter),
Tight cooperage.

SPRUCE.

Casings,
Doors,
Interior trimming,
Sash,
Stair work.

SYCAMORE.

Baskets,
Baskets (Grape),
Boxes,
Boxes (Plug tobacco),
Buckets (Candy),
Cabinet work,
Cases (Tobacco),
Fixtures (Office),
Fixtures (Store),
Furniture,
Mantels,
Organs (Pipe),
Organs (Reed),
Shooks (Box).

WHITE CEDAR.

Boat boards,
Casket shells,
Pails,
Shingles,
Ship planking,
Tubs (Wash),
Woodenware.

(WHITE) CYPRESS.

Buckets (Candy),
Pails,
Slack cooperage,
Woodenware.

WHITE PINE.

Blinds,
Boxes,
Boxes (Rough),
Cabinet work,
Casings,
Casket cases,
Cornices,
Doors,
Excelsior,
Exterior trimming,
Fixtures (Office),
Fixtures (Store),
Furniture,
Implements (Farming),
Interior trimming,
Ironing boards,
Organs (Pipe),
Organs (Reed),
Pails,
Sash,
Shelving,
Store fronts,
Washtubs,
Washboards.

WHITE OAK.

Bedroom suits,
Blocks (Base),
Blocks (Corner),
Blocks (Hub),
Boards (Base),
Bolsters (Wagon),
Brackets (Telephone pole),
Brackets (Telegraph pole),
Buckets (Water),
Buckets (Well),
Buggies,
Cabinet work,
Cabinets (China),
Cabinets (Parlor),
Carriages,
Carts,
Chairs,
Chairs (Reclining),
Chiffoniers,
Cradles,
Cultivators,
Davenports,
Doors,
Dressers,
Felloes,
Fixtures (Office),
Fixtures (Store),
Flooring,
Furniture (Mission),
Gears,
Hall racks,
Harrows,
Implements (Farming),
Interior trimming,
Lamp stands,
Lounges,
Measures,
Molding (Stock),
Panels,
Partition,
Pedestals,
Piano stools,
Piano benches,
Planters,
Plows,
Poles (Coupling),
Rolls,
Rockers,
Seeders,
Showcases,
Sideboards,
Sofas,
Spokes,
Spring bars,
Sulkies,
Tables (Card),
Tables (Extension),
Tables (Kitchen),
Tables (Library),
Tables (Parlor),
Tables (Serving),
Tables (Typewriting),
Tight cooperage,
Tongues (Wagon),
Veneers,

Wagons,
Wardrobes,
Wheels.

(WHITE) POPLAR.

Bed slats,
Boards (Cutting),
Boards (Wash),
Bowls (Chopping),
Cases (Fruit),
Crates (Truck),
Drawer bottoms,
Excelsior,
Furniture,
Mirror backs,
Packages (Vegetable),
Pails,
Tubs (Wash).

YELLOW POPLAR.

Baskets (Fruit),
Balusters,
Bed slats,
Blinds,
Boards (Cutting),
Boards (Wash),
Bowls (Chopping),
Boxes,
Boxes (Rough),
Boxes (Tobacco),
Brackets,
Buckets,
Buggy bodies,
Cabinet work,
Cabinets (Kitchen),
Carriage bodies,
Cases (Fruit),
Cases (Smoking tobacco),
Cases (Vegetable),
Cases (Casket),
Casing,
Caskets,
Ceiling,
Chairs,
Coffins,
Commodes,
Cornices,
Cupboards (Kitchen),
Cups (Berry),
Drawer bottoms,
Excelsior,
Fixtures (Office),
Fixtures (Store),
Furniture,
Hand rails,
Lamp stands,
Mantels,
Mirror racks,
Molding (Stock),
Newel posts,
Organs (Pipe),
Organs (Reed),
Pails,
Piano stools,
Porch columns,
Rockers,
Safes (Kitchen),
Sash,
Showcases,
Siding,
Slack cooperage,
Spindles,
Spools,
Stands,
Store fronts,
Tables,
Tables (Kitchen),
Tables (Library),
Tables (Parlor),
Tables (Sewing),
Veneers,
Wagon beds,
Wagon panels,
Wagon seats,
Wagon tops,
Wainscoting.

ALL OTHERS.

Cabinet work,
Interior trimming,
Mantels,
Panel work.

APPENDIX II.

WOOD MANUFACTURERS OF NORTH CAROLINA.

Concerns giving detailed information of their particular line of manufacture, from which the tables given in this report were compiled, are shown in the following list of names and addresses. Those manufacturing several products classified under different industries will appear in the list of firms named under more than one industry. This was explained previously in discussion of Table 5.

BOXES AND CRATES.

Butters Lumber Co.	Boardman.
Interstate Cooperage Co.	Belhaven.
Harrison Wagon Co.	Cary.
Hill & Daniel	Denton.
Carolina Veneer Co.	Elizabeth City.
National Box Co.	Elizabeth City.
Fayetteville Woodenware Co.	Fayetteville.
West Lumber Co.	Fayetteville.
Dudley Lumber Co.	Granite Falls.
Oettinger Buggy Co.	Greensboro.
The Pitt Lumber and Mfg. Co.	Greenville.
Greenville Lumber and Veneer Co.	Greenville.
Warlick Lumber Co.	Gilkey.
R. H. Southerland	Henderson.
Corbitt Buggy Co.	Henderson.
Henderson Mfg. Co.	Henderson.
Hutton & Bourbonnais	Hickory.
High Point Buggy Co.	High Point.
Tomlinson Chair Mfg. Co.	High Point.
J. M. Bernhardt	Lenoir.
Cahill Chair and Lumber Co.	Madison.
Magnolia Mfg. Co.	Magnolia.
White Furniture Co.	Mebane.
Kincaid Bros. Lumber Co.	Mocksville.
Morganton Mfg. Co.	Morganton.
Mount Airy Mantel and Table Co.	Mount Airy.
G. S. Waters & Son	New Bern.
Wilson Lumber and Milling Co.	North Wilkesboro.
E. E. Wollott	Odell.
Plymouth Lumber Co.	Plymouth.
W. M. Carroll	Raleigh.
J. A. Love & Co.	Red Springs.
J. H. Walker & Co.	Reidsville.
J. A. Ritchie	Ritchfield.
Parker Lumber Co.	Roaring River.
Sanford Mfg. Co.	Sanford.
Selma Lumber Co.	Selma.
S. F. Stevens	Spring Hope.
Imperial Furniture Co.	Statesville.
Bell-Cantwell Lumber Co.	Wilmington.
Lingo Box Co., Inc.	Wilmington.
Wynnewood Lumber Co.	Wilmington.
W. L. Russell Shook and Lumber Co.	Wilson.
B. F. Huntley Furniture Co.	Winston-Salem.
J. E. Shelton Box Co.	Winston-Salem.

CHAIRS.

Ashboro Chair Co.	Ashboro.
Randolph Chair Co.	Ashboro.
Newberry Bros. & Cowell	Dunn.
George Bailey	Elkin.
Overman Chair Works	Gibsonville.
Best Chair Co.	High Point.
Southern Chair Co.	High Point.
Brush Creek Bending Co.	Jordan.
Lenoir Furniture Co.	Lenoir.
Moore Furniture Co.	Lenoir.
Liberty Chair Co.	Liberty.
Cahill Chair and Lumber Co.	Madison.
Continental Chair Mfg. Co.	Mebane.
Harris Chair Co.	Mellboro.
Mocksville Chair Co.	Mocksville.
Alexander Chair Co.	Taylorsville.
Bard Lumber and Mfg. Co.	Thomasville.
Cates Chair Co.	Thomasville.
Cramer Furniture Co.	Thomasville.
Queen City Co.	Thomasville.
Standard Chair Co.	Thomasville.
Thomasville Chair Co.	Thomasville.
Dixie Chair Co.	Trinity.
Parsons Chair Co.	Trinity.
Wadesboro Furniture Co.	Wadesboro.
Walkertown Chair Co.	Walkertown.
Forsyth Chair Co.	Winston-Salem.

COFFINS, CASKETS, AND CASKET CASES.

Charlotte Casket Co.	Charlotte.
Woodland Mfg. Co.	George.
Rankin Coffin and Casket Co.	High Point.
Kelford Mfg. Co.	Kelford.
Rockwell Furniture Co.	Rockwell.
Hearne Bros. & Co.	Whitakers.
Turner-White Coffin Co.	Wilkesboro.

CROSS-ARMS.

J. C. Bruton & Co.	Fayetteville.
The W. & N. Absher Co.	North Wilkesboro.
Roaring River Mfg. Co.	Roaring River.

EXCELSIOR.

High Point Excelsior Co.	High Point.
Lexington Excelsior Co.	Lexington.
Salem Excelsior Co.	Winston-Salem.

FARMING IMPLEMENTS.

Ashboro Wheelbarrow Mfg. Co.	Ashboro.
Globe Plow Co.	Greensboro.
Wayne Agriculture Works	Goldsboro.
Raleigh Iron Works Co.	Raleigh.
A. G. Cox Mfg. Co.	Winterville.

FLOORING, CEILING, SIDING, ETC.

Aberdeen Sash and Blind Co.	Aberdeen.
Woodland Mfg. Co.	Albemarle.
Alma Lumber Co.	Alma.
W. M. Jones	Asheville.

Belhaven Lumber Co.	Belhaven.
Reddick & Windley	Belhaven.
Bridger Co.	Bladenboro.
Butters Lumber Co.	Boardman.
Waccamaw Lumber Co.	Bolton.
East River Lumber Co.	Burgaw.
Burlington Lumber Co.	Burlington.
J. L. Leary	Casar.
Bynum Lumber Co.	Cameron.
Currie & McQueen	Carthage.
Williamson & Brown Land and Lumber Co.	Cerro-Gordo.
Chadbourn Mfg. Co.	Chadbourn.
Brown Lumber Co.	Chadbourn.
Carolina Mfg. Co.	Charlotte.
Styer's Sash and Door Shops	Cherryville.
Clarkton Planing Mill Co.	Clarkton.
J. C. Taylor	Como.
Hill & Daniel	Denton.
Snider's Lumber Co.	Denton.
J. R. Smith Co.	Dixon.
Goldsboro Lumber Co.	Dover.
Huffman & Mull	Drexel.
Southern Lumber Co.	Dunn.
Dupree Massengill Lumber Co.	Dunn.
Durham Lumber Co.	Durham.
Branning Mfg. Co.	Edenton.
Rock Ford Mfg. Co.	Elm City.
Foreman-Blades Lumber Co.	Elizabeth City.
Kramer Bros. & Co.	Elizabeth City.
Parker & Thorn	Enfield.
H. Freeman & Son	Ether.
Fayetteville Planing Mill Co.	Fayetteville.
Ashboro Lumber and Mfg. Co.	Fayetteville.
Cumberland Lumber Co.	Fayetteville.
McDiarmid Lumber Co.	Fayetteville.
Regal Mfg. Co.	Forest City.
Dove Lumber Co.	Floral Springs.
Page Co.	Gastonia.
Woodland Mfg. Co	George.
J. W. Jessup	George.
Warlick Lumber Co.	Gilkey.
Pitts & Giles	Glen Alpine.
J. D. Pitts	Glen Alpine.
Broadway Lumber Co.	Glaresville.
Enterprise Lumber Co.	Goldsboro.
Walker & McAdams	Graham.
Thaw-Clapp Lumber Co.	Greensboro.
Cape Fear Mfg. Co.	Greensboro.
Guilford Lumber Mfg. Co.	Greensboro.
South Atlantic Lumber Co.	Greensboro.
E. E. Bain & Son	Greensboro.
Brooks Mfg. Co.	Greensboro.
Pitts & Monroe	Greensboro.
Pitts Lumber and Mfg. Co.	Greenville.
Bennett Bros.	Hendersonville.
Albemarle Lumber Co.	Hertford.
Hutton & Bourbonnais	Hickory.
Hickory Mfg. Co.	Hickory.
Snow Lumber Co.	High Point.
Suffolk Lumber Co.	Jacksonville.
Jacksonville Lumber Co.	Jacksonville.
Moore Lumber Co.	Jonesboro.

D. B. Sasser.....Kenly.
Kernersville Mfg. Co.....Kernersville.
Lattimore Lumber Co.....Kingsdale.
Kingsdale Lumber Co.....Kingsdale.
Lenoir Woodworking Co.....Lenoir.
Eagle Lumber Co.....Lexington.
Little River Lumber Co.....Linden.
Magnolia Mfg. Co.....Magnolia.
L. T. Cottingham.....Maxton.
United Lumber Co.....Maxton.
Nelson Cooper Lumber and Furniture Co.....Mebane.
H. A. Rankin.....Mints.
Kincaid Bros. Lumber Co.....Mocksville.
Ray Lumber Co.....Moltonville.
Monroe Mfg. Co.....Monroe.
Mooresville Furniture Lumber Co.....Mooresville.
Snow Lumber Co.....Mount Gilead.
Munger & Bennett.....New Bern.
Pine Lumber Co.....New Bern.
Broaddus & Ives Lumber Co.....New Bern.
Neuse Lumber Co.....New Bern.
Gaither Mfg. Co.....Newton.
Laus Lumber Co.....Norlina.
Davis-Keith & Connelly.....Northside.
Wilkesboro Mfg. Co.....North Wilkesboro.
E. E. Wollott & Co.....Odell.
Cohaire Lumber Co.....Parkesburg.
Parsons Lumber Co.....Parsons.
Brown-Shaw Lumber Co.....Pembroke.
Pembroke Planing Mill Co.....Pembroke.
Builders Lumber Co.....Raeford.
Baker-Thompson Lumber Co.....Raleigh.
R. D. Thompson.....Richlands.
J. A. Ritchie.....Richfield.
Messick Crate Factory.....Rocky Point.
Carr Lumber Co.....Rose Hill.
Rowland Mfg. Co.....Rowland.
Long, Spencer & Co.....Roxboro.
Oakwood Mfg. Co.....Rutherfordton.
Carpenter-Taylor Co.....Rutherfordton.
Graf-Davis-Collet Lumber Co.....Salisbury.
C. M. Thompson.....Salisbury.
C. H. Smith.....Sanford.
Selma Lumber Co.....Selma.
Shelby Woodworking Co.....Shelby.
Montgomery Lumber Co.....Spring Hope.
J. H. Saunders.....Spring Hope.
Z. T. Wright & Sons.....Star.
Sylva Lumber and Mfg. Co.....Sylva.
Southern and Norfolk Junction Planing Mill Co.....Thomasville.
Guilford Lumber Mfg. Co.....Troy.
A. Cameron.....Vass.
Frank Buele.....Wallace.
Leight Bros.....Walkertown.
Moss Planing Mill Co.....Washington.
W. B. Walling.....Washington.
House Mfg. Co.....Weldon.
Whiteville Lumber Co.....Whiteville.
Chadbourn Sash, Door and Lumber Co.....Wilmington.
Hilton Lumber Co.....Wilmington.
Bell-Cantwell Lumber Co.....Wilmington.
Wynnewood Lumber Co.....Wilmington.

C. M. & W. G. Wilson.....Wilson's Mills.
W. W. Sims Co.....Wilson.
Fogle Bros. & Co.....Winston-Salem.
J. H. Phillips.....Winston-Salem.
Miller Bros.....Winston-Salem.

FRUIT AND VEGETABLE PACKAGES.

Brown Lumber Co.....Chadbourn.
Wilkes Veneer Co.....Edenton.
Carolina Basket and Veneer Co.....Elizabeth City.
Fayetteville Lumber and Crate Mfg. Co.....Fayetteville.
Cabinet Veneer Co.....Greenville.
Greenville Lumber and Veneer Co.....Greenville.
Utility Mfg. Co.....Goldsboro.
Magnolia Mfg. Co.....Magnolia.
John T. Croom & Bro.....Magnolia.
Union Point Lumber Co.....New Bern.
James Love & Co.....Red Springs.
The Dixie Co.....Rose Hill.
Messick Crate Factory.....Rocky Point.
Eureka Lumber Co.....Washington.
Lingo Box Co.....Wilmington.

FURNITURE.

Albemarle Furniture and Mfg. Co.....Albemarle.
Yorke Furniture Co.....Concord.
Cornelius Furniture Co.....Cornelius.
Styer's Sash and Door Shops.....Cherryville.
Hill & Daniel.....Denton.
Drexel Furniture Co.....Drexel.
The Branning Mfg. Co.....Edenton.
Wilkes Veneer Co.....Edenton.
Elkin Furniture Co.....Elkin.
Elkin Veneer and Mfg. Co.....Elkin.
W. S. Rich Furniture Mfg. Co.....Elkin.
H. Freeman & Sons.....Ether.
Goldsboro Furniture Mfg. Co.....Goldsboro.
Gate City Furniture Co.....Greensboro.
Greensboro Furniture Mfg. Co.....Greensboro.
Martin Furniture Co.....Hickory.
Hickory Furniture Co.....Hickory.
Marsh Furniture Co.....High Point.
Hayworth Roll and Panel Co.....High Point.
Globe-Home Furniture Co.....High Point.
Atlantic Furniture Co.....High Point.
Kearns Furniture Co.....High Point.
Union Furniture Co.....High Point.
Welch Furniture Co.....High Point.
The Continental Furniture Co.....High Point.
Myrtle Desk Co.....High Point.
High Point Furniture Co.....High Point.
Columbia Furniture Co.....High Point.
Eagle Furniture Co.....High Point.
Southern Novelty Co.....High Point.
Lenoir Woodworking Co.....Lenoir.
Harper Furniture Co.....Lenoir.
Moore Furniture Co.....Lenoir.
Kent-Coffey Mfg. Co.....Lenoir.
Kent Furniture Co.....Lenoir.
Tate Mfg. Co.....Lenoir.
American Furniture Co.....Lexington.

Elk Furniture Co.	Lexington.
Lexington Upholstering Co.	Lexington.
Dixie Furniture Co.	Lexington.
Catawba Furniture Co.	Marion.
McDowell Furniture Co.	Marion.
Blue Ridge Furniture Co.	Marion.
The White Furniture Co.	Mebane.
Alton Mfg. Co.	Mebane.
Mocksville Furniture Co.	Mocksville.
Mooresville Furniture Co.	Mooresville.
Morganton Furniture Co.	Morganton.
Banner Mfg. Co.	Mount Airy.
Mount Airy Furniture Co.	Mount Airy.
National Furniture Co.	Mount Airy.
Mount Airy Mantel and Table Co.	Mount Airy.
Murphy Furniture Mfg. Co.	Murphy.
Oak Furniture Co.	North Wilkesboro.
Forest Furniture Co.	North Wilkesboro.
Oxford Furniture Co.	Oxford.
K. Nicholson	Pilot Mountain.
Ramseur Furniture Co.	Ramseur.
Skyland Furniture Shop	Skyland.
T. O. Spencer	Sophia.
North State Veneer Co.	Statesville.
Imperial Furniture Mfg. Co.	Statesville.
Kincaid Furniture Co.	Statesville.
Statesville Furniture Co.	Statesville.
Statesville Safe and Table Co.	Statesville.
Lambert Furniture Co.	Thomasville.
Thomasville Furniture Co.	Thomasville.
Wallburg Lounge Co.	Wallburg.
Waynesville Furniture Co.	Waynesville.
Oakland Mfg. Co.	Winston-Salem.
B. F. Huntley Furniture Co.	Winston-Salem.
Forsyth Furniture Co.	Winston-Salem.
Winston Furniture Co.	Winston-Salem.
J. E. Shelton Box Co.	Winston-Salem.
A. G. Cox Mfg. Co.	Winterville.

INSULATOR PINS AND BRACKETS.

The Blue Ridge Locust Pin Co.	Dillsboro.
J. C. Bruton	Fayetteville.
Clarence Call	North Wilkesboro.

KITCHEN SAFES, CABINETS, AND CUPBOARDS.

Alma Furniture Co.	High Point.
Kitchen Cabinet and Table Co.	High Point.
Marsh Furniture Co.	High Point.
Caldwell Furniture Co.	Lenoir.
Fitts-Crabtree Mfg. Co.	Sanford.

PIPES, PULLEYS, AND MINE ROLLERS.

Southern Roller, Stave and Heading Co.	Elizabeth City.
Boon & Thine	Fayetteville.
Putnam Pipe Co.	Phenoy.
Eureka Lumber Co.	Washington.

PLANKING FOR BOATS.

Ezzell Bros. & Co.	Sessoms.
Cain & Willis	Tarheel.
H. A. Bozart	Wade.

SASH, DOORS, BLINDS, ETC.

Aberdeen Sash and Blind Co.	Aberdeen.
Woodland Mfg. Co.	Albemarle.
Azalea Woodworking Co.	Asheville.
Wm. M. Jones.	Asheville.
J. R. Smith Co. & Dixon	Ayden.
Reddick & Windley	Belhaven.
G. W. Anthony	Burlington.
Burlington Lumber Co.	Burlington.
Bryson City Pump Co.	Bryson City.
J. L. Leary	Casar.
Carolina Mfg. Co.	Charlotte.
W. J. M. Finger	Charlotte.
Styer's Sash and Door Shops	Cherryville.
Flay Lumber Co.	Cherryville.
Sells Lumber Co.	Concord.
Snider's Lumber Co.	Denton.
Huffman & Mull	Drexel.
Southern Lumber Co.	Dunn.
Durham Lumber Co.	Durham.
Branning Mfg. Co.	Edenton.
Parker & Thorn	Enfield.
Fayetteville Planing Mill Co.	Fayetteville.
Regal Mfg. Co.	Forest City.
Bush Creek Mfg. Co.	Franklinville.
The Page Co.	Gastonia.
Woodland Mfg. Co.	George.
Walker & McAdams	Graham.
Dudley Lumber Co.	Granite Falls.
Cape Fear Mfg. Co.	Greensboro.
Guilford Lumber Co.	Greensboro.
Shaw-Clapp Lumber Co.	Greensboro.
The Pitt Lumber and Mfg. Co.	Greenville.
Hickory Novelty Co.	Hickory.
Hickory Mfg. Co.	Hickory.
Snow Lumber Co.	High Point.
Jonesboro Sash and Blind Co.	Jonesboro.
Lenoir Woodworking Co.	Lenoir.
Maxton Sash and Door Co.	Maxton.
Nelson-Cooper Lumber and Furniture Co.	Mebane.
Kincaid Bros. Lumber Co.	Mocksville.
Monroe Mfg. Co.	Monroe.
Mooresville Furniture Co.	Mooresville.
Morganton Mfg. and Trading Co.	Morganton.
J. A. Tesh	Mount Airy.
The Woodworking Co.	New Bern.
Gaither Mfg. Co.	Newton.
Laus Lumber Co.	Norlina.
Wilkesboro Mfg. Co.	North Wilkesboro.
Builders Lumber Co.	Raeford.
Baker-Thompson Lumber Co.	Raleigh.
Ellington Building Supply Co.	Raleigh.
Ellington Lumber Co.	Raleigh.
Carpenter, Taylor & Co.	Rutherfordton.
Oakwood Mfg. Co.	Rutherfordton.
C. M. Thompson Furniture and Woodworking Co.	Salisbury.
Graf-Davis-Collett Lumber Co.	Salisbury.
Sanford Sash and Blind Co.	Sanford.
Shelby Woodworking Co.	Shelby.
The Thompson-Branton Co.	Shelby.
Overcash Bros.	Statesville.
Sylva Lumber and Mfg. Co.	Sylva.

Southern and Norfolk Junction Planing Mill Co.	Thomasville.
Leight Bros.	Walkertown.
Moss Planing Mill Co.	Washington.
H. L. Moody	Waynesville.
House Mfg. Co.	Weldon.
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9. The Mining Industry in North Carolina During 1904, by Joseph Hyde Pratt, 1905. 8°, 95 pp. *Postage 4 cents.*

Gives Mines Producing Gold and Silver during 1903 and 1904 and Sources of the Gold Produced during 1904; describes the mineral Chromite, giving Analyses of Selected Samples of Chromite from Mines in Yancey County; describes Commercial

Varieties of Mica, giving the manner in which it occurs in North Carolina, Percentage of Mica in the Dikes, Methods of Mining, Associated Minerals, Localities. Uses; describes the mineral Barytes, giving Method of Cleaning and Preparing Barytes for Market; describes the use of Monazite as used in connection with the Preparation of the Bunsen Burner, and goes into the use of Zircon in connection with the Nernst Lamp, giving a List of the Principal Yttrium Minerals; describes the minerals containing Corundum Gems, Hiddenite and Other Gem Minerals, and gives New Occurrences of these Gems; describes the mineral Graphite and gives new Uses for same.

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14. The Mining Industry in North Carolina During 1906, by Joseph Hyde Pratt, 1907. 8°, 144 pp., 20 pl., and 5 figs. *Postage 10 cents.*

Under the head of "Recent Changes in Gold Mining in North Carolina," gives methods of mining, describing Log Washers, Square Sets, Cyanide Plants, etc., and detailed descriptions of Gold Deposits and Mines are given; Copper Deposits of Swain County are described; Mica Deposits of Western North Carolina are described, giving Distribution and General Character, General Geology, Occurrence, Associated Minerals, Mining and Treatment of Mica, Origin, together with a description of many of the mines; Monazite is taken up in considerable detail as to Location and Occurrence, Geology, including Classes of Rocks, Age, Associations, Weathering, method of Mining and Cleaning, description of Monazite in Original Matrix.

15. The Mining Industry in North Carolina During 1907, by Joseph Hyde Pratt, 1908. 8°, 176 pp., 13 pl., and 4 figs. *Postage 15 cents.*

Takes up in detail the Copper of the Gold Hill Copper District; a description of the Uses of Monazite and its Associated Minerals; descriptions of Ruby, Emerald, Beryl, Hiddenite, and Amethyst Localities; a detailed description with Analyses of the Principal Mineral Springs of North Carolina; a description of the Peat Formations in North Carolina, together with a detailed account of the Uses of Peat and the Results of an Experiment Conducted by the United States Geological Survey on Peat from Elizabeth City, North Carolina.

16. Report of Convention called by Governor R. B. Glenn to Investigate the Fishing Industries in North Carolina, compiled by Joseph Hyde Pratt, State Geologist, 1908. 8°, 45 pp. *Postage 4 cents.*

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BULLETIN 224 JANUARY, 1914

Walter Mulford

NORTH CAROLINA

AGRICULTURAL EXPERIMENT STATION

CONDUCTED JOINTLY BY THE

STATE DEPARTMENT OF AGRICULTURE

AND THE

COLLEGE OF AGRICULTURE AND MECHANIC ARTS

RALEIGH AND WEST RALEIGH

TOP-WORKING SEEDLING PECAN TREES

BULLETINS OF THE STATION WILL BE SENT FREE TO CITIZENS OF THE STATE ON REQUEST

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TOP-WORKING SEEDLING PECAN TREES

By W. N. HUTT, Horticulturist.

According to a census we have just completed, there are in this State upwards of 50,000 seedling pecan trees. These trees range in age from one to thirty years. Seventy-five per cent of them are of bearing age, but there is probably not 1 per cent of that number that are profitable bearing trees. In all parts of the pecan country experience has shown that seedling pecans are notably slow in coming into bearing, and some trees never bear at all. Those that do bear have nuts that are almost invariably small, thick-shelled, and of indifferent quality. In this respect, however, the pecan tree differs in no way from any of our other classes of fruits. No one would to-day be so foolish as to try to get a good peach or apple orchard by planting the seeds of these fruits; but this is just what a great many people have been trying to do with pecans.

This attempt to produce pecan orchards from seed has been the origin of the 50,000 trees noted in the census above. Now that we have these seedling pecan trees, are they of any value at all? Can we make anything out of them whatever, or must we cut them down and charge up the expenses to the account of experience, and start over again with standard varieties of budded and grafted trees? Years of time and quantities of money have been spent in producing these beautiful but comparatively valueless seedling trees. However, they are far from being a total loss, for in those deep roots and stalwart trunks and spreading branches there are latent possibilities in abundance. If by some magic power like that of Aladdin's wonderful lamp told of in the Tales of the Arabian Nights, we could transform these seedling trees in a single night to standard varieties, we would enrich every owner of pecan trees by hundreds of dollars, and the aggregate wealth of the State would be increased by millions.

For several years I have been in search of Aladdin's wonderful lamp to enlighten me how to effect this felicitous transformation. Like Aladdin's quest of old, the search has been long and wearisome and has led me a tedious road through many vexatious disappointments; but at last I have found the lamp! I have in my power the magic by which a worthless seedling pecan tree can be transformed into a productive standard variety. This magic talisman is simply **patch budding.**

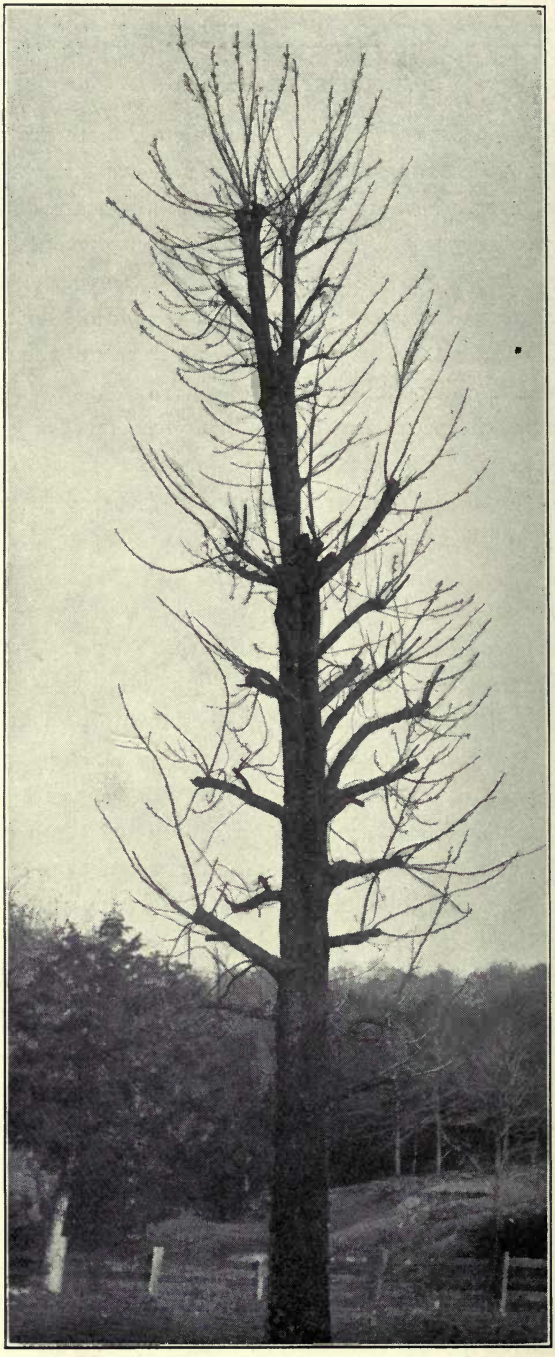

FIG. 1. Large seedling pecan tree being top-worked.

Every kind of budding is magical. Is it not wonderful to make a crab-apple tree produce Stayman or Grimes Golden apples or a quince bush produce luscious Duchess pears? Is it not strange that the sap from the same root can produce red apples on one branch, yellow ones on another, and russets on a third? How does it come that one twig can be made to produce sour apples and the next Paradise Sweets? Strange! Wonderful!! but True!!! It is all owing to the fact that the sap of a tree is a homogeneous substance and that it is the bud through which it passes that stamps the individuality upon it, whether it shall be a crab or a Grimes Golden. If we make all the buds of the tree of the Grimes character, the apples will all be Grimes Golden. In the same way, if we make all the buds on a pecan tree Stuarts or Schleys, there will be nuts to be gathered from that tree, and they will not be worthless scrub seedlings.

When I began my experiments in the top-working of seedling pecan trees I soon found that there were many things one could **not** do with pecan trees. I counted myself a successful propagator of apples, peaches, plums, grapes, and various other kinds of plants; but apple, peach, and general propagation methods failed to give success in the budding and grafting of pecans. I concluded the method must be all right, but that I should be more exact about my mechanical manipulations. I started out with the ordinary cleft graft commonly used for top-working most sorts of trees. I experimented in several different orchards and put in hundreds of cleft grafts. I took great pains to make my work as mechanically perfect as possible. All conditions of stock, cions, weather, etc., seemed to promise the highest degree of success. The result of that season's work was a world of disappointment, a lot of experience, and two living grafts. One of these latter, the result of my skill, was so effectively pruned that fall by the pecan girdler that my work for the season was practically a minus quantity in all but experience. The other living graft, which was put in by an assistant, is now a bearing Curtis tree, our only monument to the success of cleft grafting the pecan. Other propagators are said to be able to secure fair results with cleft grafting of pecans in certain localities; but from my experience, I am willing to aver that it cannot be done in this latitude.

Next followed a series of trials with shield budding, which is so uniformly successful with peach; but peach methods failed entirely with

pecans. Then followed a succession of trials with whip grafting, veneer grafting, bark grafting, and chip budding, all with a varyingly large percentage of failure and a uniformly small percentage of success. Some propagators in the South report fairly successful results in the chip budding of pecans, but my results with this method were largely of a negative character.

After persistent trials of all the known methods of budding and grafting, through the varying conditions of four successive seasons, I have narrowed the propagation of the pecan in North Carolina to one single method, namely, patch budding. This method has, year after year, given us the highest percentage of successful unions. The operation, illustrated by figures 1 to 10, is as follows:

1. HEADING BACK.

During the dormant period, which is, roughly speaking, from November 1st to March 1st, the seedling trees are cut back to stubs, the ends of which may be from 1 to 3 inches in diameter. Wounds larger than this size take years to heal and endanger the life of the tree. Large trees can be operated on as well as small seedlings, only one has to go higher up so as not to cut too large limbs. Figure 1 shows a seedling pecan tree 18 inches in diameter, which was stubbed back in the winter of 1911-12 and successfully budded the following summer. The result of this drastic heading back is a numerous growth of vigorous, rapidly growing shoots near the ends of the stubs, by which nature endeavors to heal over the wounds. The cambium in these vigorous, sappy shoots is in the most active condition possible; just the condition most suitable for the union of stock and cion. This optimum condition cannot be secured except by the forced growth as the result of the heading back. Our experiments, year after year, have shown that on the ordinary new shoots, even on active young seedling trees, the percentage of living buds was much less than on the forced shoots of the headed-back trees.

The different steps in the operation of patch budding are briefly as follows:

First operation: Making parallel cuts on stock. See figure 2.

Second operation: Making vertical cut to remove bark from stock. See figure 3.

Third operation: Loosening patch on stock. See figure 4.

Fourth operation: Making parallel cuts on cion. See figure 5.

Fifth operation: Making vertical cut to remove bud patch from cion. See figure 6.

Sixth operation: Taking bud off bud stick. See figure 7.

Seventh operation: Inserting bud on stock. See figure 8.

Eighth operation: Beginning the tie. See figure 9.

Ninth operation: Wrapping the bud. See figure 10.

Tenth operation: The completed operation. See figure 11.

The accompanying illustrations should make the method self-explanatory.

KNIVES FOR PATCH BUDDING.

Two sorts of knives are used for patch budding; the double ones shown in figure 12, *b* and *c,* for making the parallel cuts and the ordinary budding knife, figure 12 *a,* for removing the patch.

CAMBIUM.

Professor Bailey, in his Encyclopedia of Horticulture, says: "The ways and fashions of grafting are legion. There are as many ways as there are ways of whittling. The operator may fashion the union of stock and cion to suit himself if only he apply cambium to cambium, make a close joint and properly protect the work."

The fundamental basis of the whole science of grafting is cambium. What, then, is this important substance by means of which one plant may be made to live and grow and produce on the roots of another? If we strip off the bark of any actively growing, woody plant we will find just beneath a soft, colorless substance; this substance is cambium. It feels slimy to the touch, and if scraped with the finger nail a little doughy mass can be raised. As we examine it it will be seen to quickly darken to cream color, then to yellow, and finally to dark brown. A change has taken place in it in a few seconds, right under our eyes. When we first exposed it, it was living, active, and capable of building the most complicated of plant structures; now it is dead, inert, and impotent. If we examine the smallest portion of this doughy mass under a compound microscope we will find it not merely slime, but a highly organized tissue made up of countless minute cells, each with a delicate wall about it and containing a thickish liquid (protoplasm). The cambium cells are brick-shaped, and are placed end to end, with layer overlapping layer, like bricks in the wall of a building. The microscopic

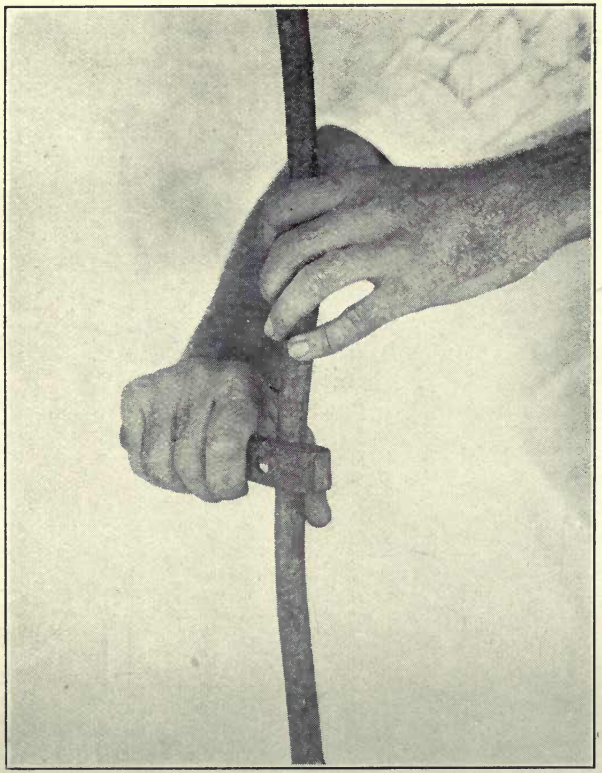

FIG. 2. *First operation:* Making parallel cuts on stock.

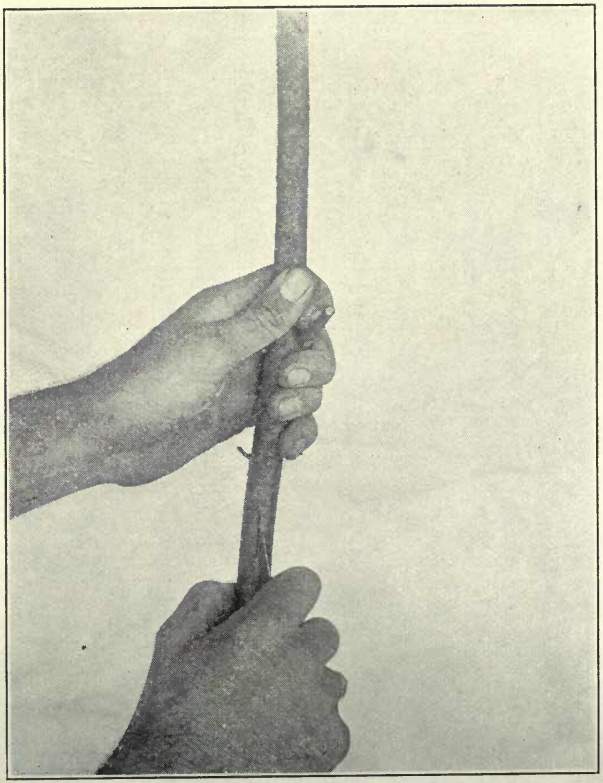

FIG. 3. *Second operation:* Making vertical cut to remove bark from stock.

FIG. 4. *Third operation:* Loosening patch on stock.

FIG. 5. *Fourth operation:* Making parallel cuts on cion.

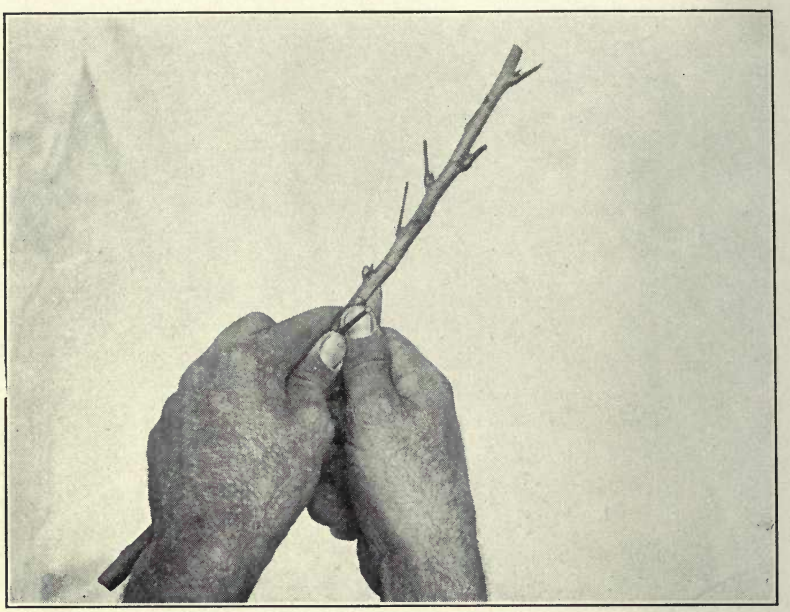

FIG. 6. *Fifth operation:* Making vertical cut to remove bud patch from bud stick.

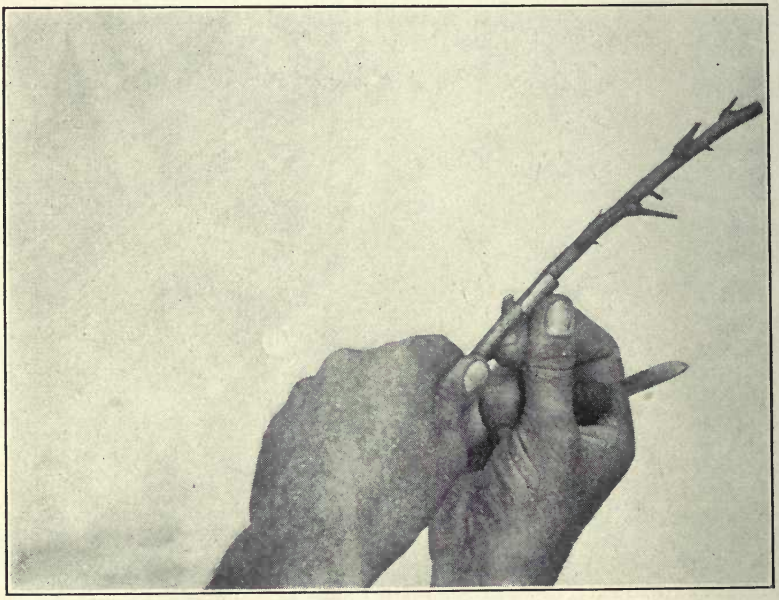

FIG. 7. *Sixth operation:* Taking bud off bud stick.

FIG. 9. *Eighth operation:* Beginning the tie.

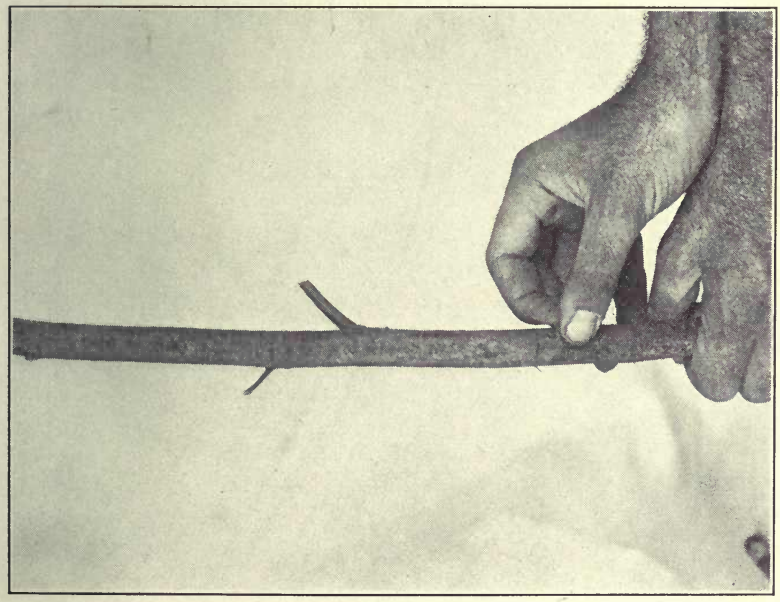

FIG. 8. *Seventh operation:* Inserting bud on stock.

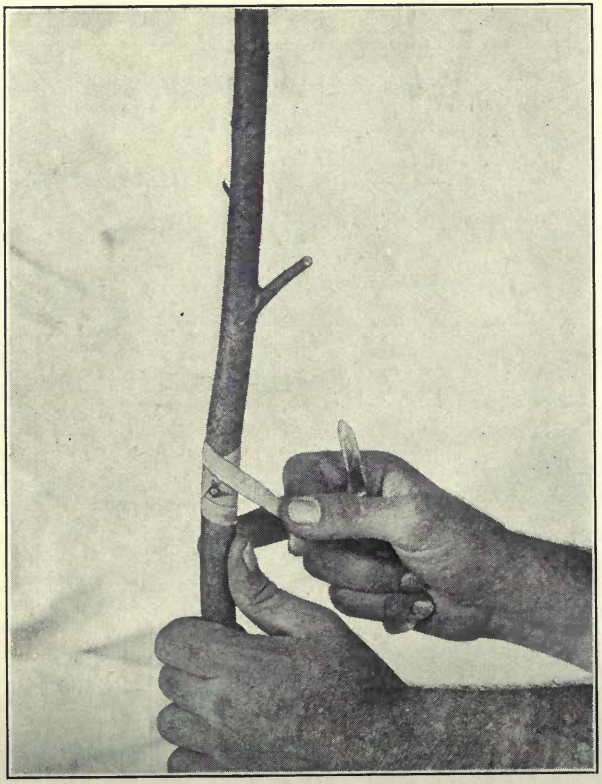

FIG. 10. *Ninth operation:* Wrapping the bud.

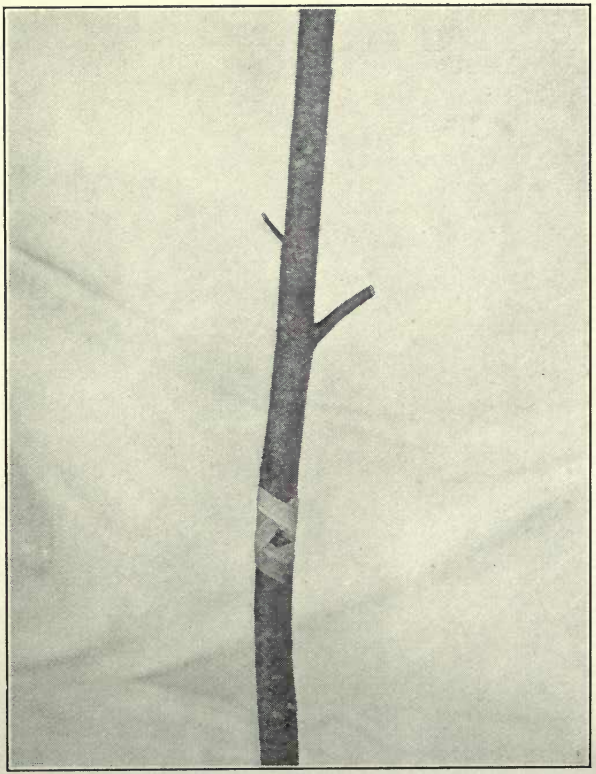

FIG. 11. The completed operation.

structure of cambium tissue gives us a clearer conception of its extreme delicacy. It is one of the most sensitive and delicate substances in all nature. Exposure to the air will kill it and completely destroy its functions in a few seconds. It is easily crushed by slight pressure and quickly killed by exposure to drying, frost, moisture, and sunlight. Nature shows her extreme care of it, for in making bark she has formed for the delicate cambium a perfect protective covering. Like the cambium, the bark is composed of cells, as in fact are all animal and vegetable structures. But the cells of the bark have thick walls of a tough, corky substance, and each cell contains air instead of protoplasm. The corkiness of the bark makes it an impervious, waterproof covering that does not allow the cambium to be dried out or to be washed by external moisture. The air in the bark cells being in a still condition, is a non-conductor of heat, and layer of bark overlapping layer, the cambium is completely covered with a dead-air blanket. This keeps it from being frozen in winter and from being overheated in summer, just as a dead-air space in the walls of a building protects from extremes of heat and cold. From this it is plain that nature takes great pains to cover and protect the delicate cambium from all external influences. This stands in striking contrast to the careless manner in which many propagators and planters handle the delicate parts of trees. It also explains why some budders get such a small percentage of living buds and planters so few living trees.

Cambium is the building material of plants, and without it growth is impossible. It covers every portion of the tree from the topmost terminal bud to the deepest root tip like a living blanket. During the growing season the cambium cells divide lengthwise, forming new cells. These divide again and grow, and new cells are formed, until by fall a complete mantle of bark covers the outer surface of the cambium, while within it has built up a solid layer of the woody structure of the tree. A few rows of cambium cells are left in an embryonic condition to carry on growth the following year. The cambium is thus the only tissue of the tree that retains from year to year the power of active growth. The layers of wood and bark, after performing their functions for a few seasons, gradually die and are overlapped by new layers; but the cambium remains living throughout the entire life of the tree, even if it be, as in the giant Redwoods, thousands of years.

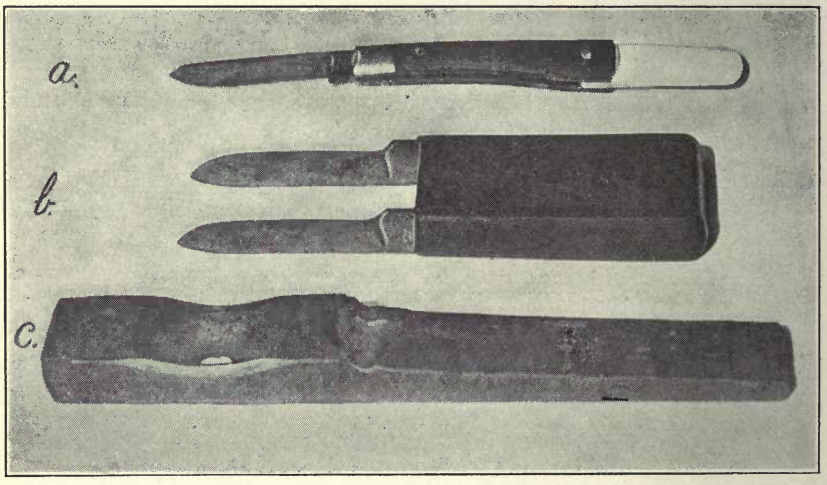

FIG. 12. Knives for patch budding.

Besides forming the regular wood of the tree, the cambium also grows out over cut places and builds in woody tissues that heal over the wounds. It is owing to this fact alone that budding and grafting are possible. The callus on cuttings and root grafts is another evidence of the same phenomenon, for the cambium of the roots of a tree is continuous and identical with that of the branches.

THE STOCK.

The whole practice of successful grafting and budding is the proper handling of active cambium. The cambium is the cementing material that unites stock and cion, and unless there is active cambium there will be no union. It must be said here that no matter how great the future growth of the union, the cion never becomes truly united or fused with the stock. The cambium grows all over and around the cut parts and cements them together; but if the graft union be split open fifty years later, the dead wood of the original cion may be found of the original size and in the original position. Since, then, successful grafting depends on the union of the cambium of the stock with that of the cion, theoretically the best time for grafting and budding would be when the cambium is most active. Actual nursery practice shows that this is practically correct, at least as regards the stock.

The ideal stock for propagation purposes is the young seedling of one or two years growth. In such a stock all the tissues are new and fresh and working to their maximum capacity, and the cambium is in its most active condition. In top-working old trees it will be found that though the branches may appear vigorous, they are a long way from having anything like the active circulation found in small seedlings. Buds put in these branches would give a very small "live," while the same care on nursery seedlings could be counted on giving a high percentage of living buds. In top-working, therefore, it is found necessary, in order to get the cambium sufficiently active, to stub back the branches to mere pollards. This cutting back should be done in the winter or dormant season. The following growing season will see a dense growth of very vigorous shoots trying to repair the injury. See figure 1. These shoots are ideal stocks, for, on account of their having all the sap from the greater root of the mature tree, the cambium will be even more active than in the nursery seedling. Often when nursery seedlings are in partially dormant condition, owing to unfavorable weather or other con-

ditions, they may be forced into budding condition by slashing off part of the growth above where the buds are to be inserted. In our top-working experiments this fact was further emphasized by a windstorm which broke off many of the sappy shoots just above where the bud was put on. Every single one of these buds "took," though some others, just as carefully put on, failed. The success of all the buds on the wind-broken shoots was undoubtedly due to the forcing of the cambium growth just at the point where the bud was inserted.

THE CION.

Although it is desirable to have the cambium of the stock in an active growing condition, it is quite the reverse with the cion. The reason of this is evident, for if the cion were active, it would soon exhaust its small supply of food and die before the union could be formed and it could get its permanent supply of nourishment from the root. It is desirable to have cions fresh and firm but in a quiescent condition until pushed into activity by the growth of the stock. If, on the other hand, the cions or buds become too dry the sap will not be able to revive them and no union will be made.

For patch budding, the buds may be cut from cions or bud sticks of the present or the past season's growth. Figure 13 shows a bud stick of the present season's growth from which the leaves have been cut. Such a bud stick cannot be obtained until July, for before that time the bark is so tender that it is impossible to get the bud patch off the stick without crushing it or peeling off the cuticle of the bark. The basal buds of the present season's growth (figure 13, a, a, a) make the best buds, because they are more mature and dormant than the buds above them, and as they have shed the leaf stalk, they can be tied in more easily and snugly than those with the thick, fleshy base of the leaf stalk attached. Some budders make a practice of cutting off the leaves ten days or two weeks before they commence budding and leaving the cions on the trees to ripen the buds and shed off the bases of the petioles. There is in this way no danger of the thick fleshy leaf base decaying under the wrap and souring and killing the buds.

Figure 14 shows budwood of the previous season's growth. This budwood can be cut during the winter and kept over in fresh dormant condition by being packed in damp sawdust and carried over in ordinary

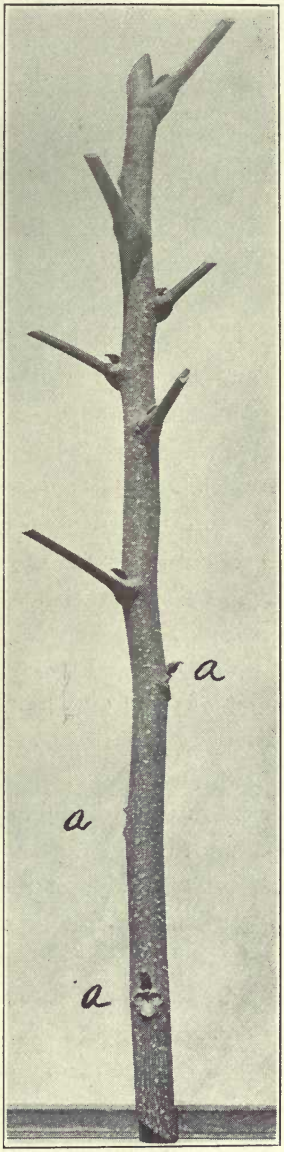

FIG. 13. Bud stick of present season's growth. Desirable buds at a, a, a.

cold storage or in a refrigerator. It will be ready for use in the spring as soon as the bark will slip on the stocks. By this method the budding season may be greatly extended and propagation started at least two months before any of the present season's buds will be sufficiently mature for use.

THE KINDS OF BUDS TO SELECT.

As to the buds themselves, the most desirable are those at the base of the season's growth. See figure 13. These, though not large, are plump and fully mature. The bark is smoother and firmer about them than higher up the stem, and there is no leaf stalk to interfere with cutting them accurately and making a close fit and tie. These buds are dormant, and there is little danger of them pushing into growth in the fall and being cold hurt the following winter. For best success in patch budding it is not desirable to select very large, overdeveloped buds, or those that have grown so rapidly as to stand out on a little pedicel or basal stalk. In removing such a bud from the stick, the central column of the pedicel will often pull out and remain on the stick. Such a bud will almost invariably die. An observation of pecan buds in general will show that they are normally triple in form, the largest above and two smaller ones beneath it. The largest bud will grow first, but if anything happens to it, the next one will take its place.

TYING IN THE BUDS.

A good deal of the success in patch budding depends on the tying-in of the buds. The cambium must be thoroughly protected if a union is to result. It is necessary to have some kind of tie that will retain the sap as well as exclude external moisture. After experimenting with different materials and methods, I have finally abandoned all except the waxed strip tie. This is made by dipping sheet cotton in pure liquid beeswax, and pressing out all extra wax. The cloth after dipping is formed into convenient sized rolls. From these rolls the cloth is torn at budding time into strips a quarter of an inch wide and from 8 to 10 inches long.

In tying in a bud, hold it firmly so that it will not slip, and begin at the top and bind it in very tightly with the waxed strip. Reverse the tie at the rear of the bud like a surgeon's bandage and cover the patch completely, leaving only the tip of the bud sticking out. The wax in the cloth will cause the tie to adhere sufficiently to the wood that no other

FIG. 14. Bud sticks: a, a, wood too old; b, b, showing buds of two seasons growth; c, c, bud wood too small: d, d, vigorous bud wood showing good buds.

ligature is required. In budding in the spring, when the flow of sap is very copious, it is well to tie in a small splinter about the size of a match just below the bud to drain off the excess sap. This will save many buds from being killed by souring of the sap. In two to three weeks time the tie should be loosened so that the rapid growth of the stock will not cause the tie to cut into the bark. Figure 15 shows a bud from which the tie has been removed.

THE MECHANICS OF PATCH BUDDING.

After all has been said about cambium and stocks and cions and their relation to each other, there are still volumes to be written on the mechanics of pecan propagation. I do not want to scare any one off from trying, but if there is any plant more difficult to propagate than the pecan, I have not yet found it. Even experienced propagators of general nursery stock have given up pecan budding as a bad job. On the other hand, a novice or "pecan crank" who is handy with tools and has the patience to study out the causes of his failures, may acquire the skill to obtain almost a perfect "live" of buds. This all goes to show that extreme precision is the password in the mechanics of patch budding. In the first place, the knives should be of the finest quality, so that they will hold a clean, fine edge. All cuts should be made with accuracy and precision, so that there are no rough edges and bias corners. The number of living buds will, under ordinary circumstances, be in exact proportion to the accuracy with which the bud patch fits the place made for it on the stock. The experienced pecan budder as he takes the buds off the stick can tell whether or not they will grow. If he tears the bark in cutting the patch, he drops that bud and cuts another; if the bud patch splits, he discards it; if his fingers touch the cambium or the bud patch falls to the ground, he wastes no time with it, but cuts another and another until he gets the conditions perfect. There is little use in tying in any bud that does not fit perfectly. For this reason it is desirable to have the budstick as near the same diameter as the stock. The bud patches from thin or small cions have to be stretched to fit and generally give a poor "live"; likewise, the buds from the more or less ridged portion at the top of the budstick. The transfer of the bud patch should also be made quickly, so that the cambium will have the shortest possible exposure to the air.

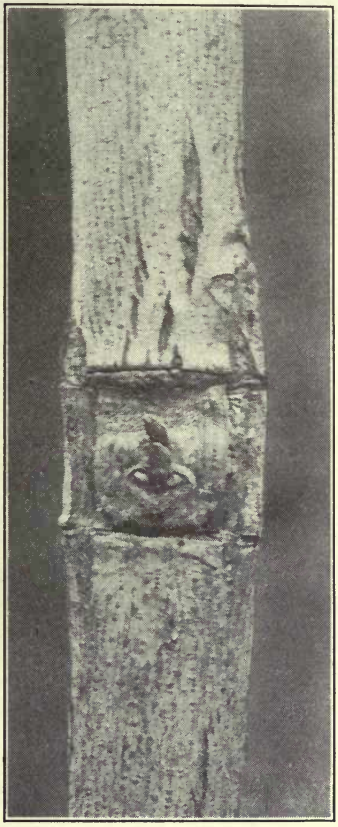

FIG. 15. Inserted bud with tie removed.

FIG. 16. Seedling grove stubbed back for top-working.

FIG. 17. A top-worked bearing pecan tree.

AFTER TREATMENT.

The process of patch budding is not complete even after a good "live" of buds is secured. It still requires some judicious after-treatment to get them into good normal growth. On account of the drastic heading back the tree has received, practically every dormant bud will be forced into active growth. These will push out so vigorously in spring that if not held in check they will completely overgrow and crowd out the buds put in. Attention should be given during the early growing period to see that the buds put in have sufficient room for proper development. If all or too many of the seedling buds are rubbed off, the inserted buds will not be able to carry all of the heavy flow of sap, and so may be drowned and killed. On the other hand, the inserted buds may not start unless forced by the extra sap obtained by rubbing off a portion of the seedling buds. A good deal of horticultural judgment is required to adjust the proper balance between the seedling and the inserted buds so as to get the best development of the latter. When the inserted buds are able to carry all the sap of the tree, all seedling shoots should be cut out and attention directed towards forming the new growth into a strong, symmetrical top.

If conditions are favorable, there will generally be some nuts the second season. By the third year the transformation from the seedling to the named variety should be complete, and a good crop of high-class nuts should be expected.

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